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CONTENTS.

Editorial 139
The Latest Central Station Statistics..... 142
Court of Patent Appeals..... 142
Argenta, Ark., Municipal Lighting Plant..... 142
Electrical Row in Winnipeg, Manitoba..... 142
Figures of the Production and Use of Copper..... 142
Electrically Welded Rails..... 143
Discussion of U. S. Patent System..... 143
Stability in Electric Lighting Circuits..... 144
Work of the Engineering Staff of Wisconsin Tax and Railroad Commissions 145
Commutation in Alternating-Current Series Motors..... 147
Boston Edison Employees' Lecture Course..... 147
Third Annual Meeting of the Illuminating Engineering Society..... 147
Chicago Electrical Show..... 148
Electric Furnaces 148
Umbrella-Type Insulators 148
Field Core for Turbo-Alternator..... 149
Manufacture of Tungsten Filaments..... 149
System of the Rochester Railway & Lighting Company..... 151
Factors Governing the Space Utilization of Electromagnetic Windings. By Charles R. Underhill..... 155
A Classification of Electrical Engineering Data. By George W. Lamke 157
The Theory of Lightning—II. By Daniel S. Carpenter..... 158
Lighting Development at Boonton, N. J..... 161
Electric Light Situation in Central New York. By William H. Stuart 161
Use of the Words Wire and Cable..... 163
Concealed Knob and Tube Wiring..... 163
Standard Electric Wiring in Small Towns. By W. J. Canada..... 163
New Telephone Patents..... 165
Droughts: Also Floods and Freshets and Water Power Plants. By Clemens Herschel 165
Digest of Current Electrical Literature..... 167
New Tungsten Reflector and Fixtures..... 171
Triangular Bit for Boring Square Holes..... 172
Motor-Driven Box-Car Loader..... 173
Largest Meat Cutter in the World..... 173
Portable Electric Breast Drill and Grinder..... 173
Electrical Trade Society of New York..... 174
Silundum 174
Industrial and Commercial News..... 175
General News 179
Weekly Record of Electrical Patents..... 185

Latest Central Station Statistics.

The Bureau of the Census has just issued the broad figures of the central station industry for 1907, these being the statistics of the regular five-year period required by law. We give the data place on another page, and hope soon to follow them with corresponding figures for the electric railway, telegraph and telephone industries. It is a large undertaking, but is well within the capacity of the Census Office and is carried out with painstaking care. The figures are as near absolute accuracy as it is possible for anyone to come in this country, and in their general extent and detail are not approached by those of any other civilized nation. The next step, indeed, will be in the direction of international effort and comparison of result.

Since the last figures were compiled, those of 1902, we have made an effort to keep pace by an annual estimate, and are now glad to find that our approximations are very close and exact. An estimate has been made of a billion-dollar investment up to 1908. The returns show $996,000,000. The actual capitalization will of course be larger, reaching our estimates of from $1,200,000,000 to $1,500,000,000 at least. The income is given as $175,000,000 in 1907. This does not include the large business done by electric railway companies operating lighting plants. Our total figure for 1908 of $225,000,000 is probably within a million or two of exactitude. The arc lamps are given as 555,000 and the incandescents as 41,000,000. Our estimate of incandescents has been "over 30,000,000," but the difficulty comes in with many companies that report 16-cp equivalents, including all the hundreds of thousands of fan motors on their circuits, the heating apparatus, the cooking appliances, etc. The truth lies somewhere between 30,000,000 and 40,000,000.

The percentages of increase are notable all along the line. The investment and the income have doubled in five years, the kw-hour output has increased 133 per cent, the generator capacity has increased 207 per cent, the "incandescent" service has increased 129 per cent, and the motor capacity has jumped 276 per cent. These are all notably encouraging figures. Let us all take hope from them. The industry is evidently growing steadily at a rate of about 20 per cent a year, and bids fair to keep it up.

A Little More Light in Radium.

The recent work of Rutherford tending to show that the helium atom is the positive charge carrier in the case of radioactive substances, brings at last some phases of the radium problem within a measurable distance of solution. If confirmed, which it should be as soon as possible by independent

investigators having no theories upon the subject, it brings an opportunity for examination of the questions involved from the chemical side which, for lack of material and any definite method of attack, has been sadly neglected. Helium is a well-defined substance which is obtainable in finite quantities instead of in infinitesimals, and can be made the starting point of chemical investigation. As to the facts, there is no particular reason to suppose that Rutherford is in error other than the general doubt that hangs about the investigation of minute traces of things in vacuum tubes. Anyone who is familiar with such work gets somewhat cautious, and lack of a conservative viewpoint is likely to cause trouble, as in the case of Sir W. Ramsay's lithium from copper. Now, if one were working with an unknown and unstable substance having properties akin to those possessed by several kindred unknown substances, and found out that in each case there was given off during a period of unknown instability, let us say nitrogen, would not one be justifiably inclined to think that the substance in question contained combined nitrogen which was given off by ordinary decomposition; and would not one set industriously about trying to find out the rest of the combination?

Now, in the case before us we clearly have the property of activity commitant with what appears to be the splitting off of a comparatively simple and well-known gas, which happens to be the positively charged element of the combination. It is not long ago that upon the strength of this the radium contingent would have loudly proclaimed that positive electricity was nothing more or less than helium upon just as valid ground as they have held the accompanying sub-atomic débris to be negative electricity. On the present showing such treatment would obviously put the cart before the horse. If one finds that a substance which is radioactive spontaneously gives off helium, does it give off helium because all radioactive elements degrade into helium and other things, or is it radioactive because that especial sort of instability is common with certain compounds of helium not unusual in certain rare minerals? And is the helium in said minerals there because it has been derived from the decomposition of thaumaturgic new elements or merely because it was there in combination, like sulphur or hydrogen, and is easily driven out? And by the way, what becomes of the rest of the combination when radium breaks up and gives off emanation? One starts with so-called radium bromide ordinarily. When emanation appears, which is associated with helium, where does the bromine go and what else happens? It is more than a year since the finding of helium was announced, but of the promised information regarding the company in which it was found nothing has yet leaked out. This latest work seems to offer about the first chance for tackling the properties of radioactive substances from the chemical side. In organic chemistry the synthesis of a natural substance is the investigation of its breakdown products; the next, patient efforts at rebuilding with some of these products as starting points. The time seems to be about ripe for an attack on the problems of radioactivity from the chemical side, possibly via helium.

Space Utilization of Electromagnetic Windings.

Many thousands of electromagnetic coils are wound every year for duty in a great variety of applications. Telephony demands a great number, because every telephone switchboard outfit usually employs at least two coils per subscriber's line. Telegraphy demands a large number for relays, sounders and the like. Electric power transmission and distribution demand many, in motors, dynamos, transformers, automatic switches, relays, etc. The same fundamental mechanical and electromagnetic principles apply to all of these coils, and these fundamental principles are expressed in many text-books. Speaking in a rough and general way, there is nothing simpler than a determination of the turns, weight and m.m.f. of a winding from the size of the wire used and the geometrical dimensions of the winding space. Nevertheless, if we examine into the matter in detail, so as to attempt a fair degree of accuracy, there is much uncertainty in the matter, and it is very hard to arrive at any of these values, within, say, 1 per cent. Fortunately, it is seldom that such a degree of precision is practically demanded in the predetermination or analysis of coils, but it is desirable to have conveniently at hand the data upon which to base a careful estimate when the occasion arises for a particularly close computation.

A very important factor in dealing with the properties of a winding is the coefficient of space-utilization, or the ratio of the volume occupied by copper to the volume of total winding space in a coil. This coefficient depends not only on the thickness of the insulating cover on the wire, but also upon the care with which the wire is wound. If the wire is wound carelessly and hastily with a free use of paper between layers, the coefficient of space utilization in the coil may fall below 25 per cent; whereas with fairly large wire of square cross-section and thin insulation, carefully wound, the coefficient may exceed 80 per cent. Some of the influences affecting the space utilization coefficient are discussed by Mr. Charles R. Underhill in the article on page 155 of this number. He shows that two influences tend to increase the coefficient in a coil of any given dimensions, wound with insulated wire of given size—namely, (1) imbedding of the turns of one layer between the adjacent turns of the underlying layer, and (2) the compression of the insulating coatings under the tension of winding and the pressure of superincumbent layers. On the other hand, there are certain influences which tend to diminish the coefficient—namely, (1) the loss of one turn in each layer, due to incomplete filling at the ends of the layer, and (2) the inclination of the spirals in each successive layer alternately to one side and to the other of true perpendicular planes.

The article shows that if the imbedding action were perfect for round wire, so that every turn lay depressed throughout its periphery between the two adjacent turns of the underlying layer, the total thickness of the winding, after the first layer, would be reduced in proportion to the cosine of 30 deg., or 0.866, as compared with wire that was nowhere imbedded. This would involve a reduction of winding volume of 13.4 per cent, after the first layer. But examination shows that, in practice, each layer is completely imbedded at one diameter, and rides up, or is not imbedded, at the diameter perpendicular thereto; so that the saving in volume effected by imbedding, with carefully wound coils, can only be half the above amount, or 6.7 per cent, which is equivalent to increasing the coefficient of space utilization by 7.2 per cent. The influences which conspire to diminish the coefficient, even in the face of careful winding, tend to offset the gain due to imbedding. One of the most interesting dis-

closures of the article is the statement of experimental results, discussed in connection with Fig. 12. It appears that sizes of single silk-covered magnet wire, ranging from No. 21 to No. 34, were wound carefully by hand to a depth of eight layers in a steel bobbin of ½-in. internal diameter and 1-in. interflange.

According to the results, given in Fig. 12, the actual winding depth of the eight layers was always seven-eighths of the total thickness estimated from the size of the wire, assuming neither compression nor imbedding. As pointed out in the article, this means that there was in each case a compression amounting in utilization coefficient to about 6 per cent. It is curious to find the reported compression so nearly uniform. One would naturally have supposed that it would have varied with the diameter of the wire. It must be remembered, however, that, in practice, coils are often padded to a considerable extent with paper, so that the interesting conditions discussed in the article are often honored more in the breach than in the observance.

THE NATURE OF LIGHTNING.

We publish elsewhere in our columns some very interesting speculations of Mr. D. S. Carpenter regarding the genesis of lightning and the sources of some of its striking peculiarities. So little is known regarding the nature and sources of atmospheric electricity that every such suggestion is helpful. It remains to-day almost as much a mystery as in the far gone years when the skinclad Norseman heard in the storm the mighty blows of Thor's hammer. From the theoretical standpoint the greatest difficulty is presented by the constitution of a thundercloud, consisting as it does of discrete charged bodies distributed in a partially insulating vaporous medium of unknown condition of ionization. It is a condition that almost defies analysis, and it is certainly extremely difficult to form any definite physical conception of the laws of surface charge in a volume so constituted. It would be indeed interesting to consider whether the ordinary laws of static charge which tacitly assume a homogeneous surface conducting sheet hold at all for a charged cloud in their usual sense. If they do, is such a condition stable or is it the condition precedent to immediate discharge? Sometimes one notes discharge between clouds in the form of a brilliant sheaf of discharges looking quite like a photograph of the volley of sparks from an inductorium, while again there may be an apparently single tremendous discharge sometimes accompanied by induced discharges between other clouds. This diversity of phenomena suggests very forcibly a great diversity in the precedent electrical conditions.

One of the most troublesome things to account for in any general theory of lightning is the potential difference between cloud and cloud which produces the class of lightning just referred to. Difference in condition of aggregation to which Mr. Carpenter refers seems as plausible a source as any, yet the potentials involved are so enormous as to introduce serious difficulties even on this hypothesis. Flashes apparently take place between cloud and cloud over distances greater than from either cloud to earth, say, half a mile or more. Storm clouds generally lie low down, and there are some reasons for thinking that the lower strata accumulate inductively or through the downward drift of growing particles, a great excess of potential. The lightning as seen from above a cloud is often a mere blue glare far more suggestive of brush discharge than of the intensive phenomena of a flash. In such case is the appearance due to participation of the higher strata in the flash or is it the immediately subsequent readjustment of potential? It is very desirable to accumulate experimental evidence on points like this through a study of the time functions involved in lightning. In particular, these are very important from a practical standpoint as modifying the principles of lightning protection. Data derived from electric lines are for this purpose of relatively little value since they must always be, as Mr. Carpenter suggests, complicated by the constants of the line. There is good reason to think that an actual discharge, taking place as it does through a somewhat highly resisting air path between very large capacities, is a far more deliberate phenomenon than used generally to be supposed, and virtually non-periodic. The periodicity ascribed to lightning is generally a surge periodicity due to the line upon which observations are made. The thing which ought if possible to be ascertained is the steepness of the main wave front, which determines the behavior of the discharge toward inductances and capacities in its path.

The curving instance cited by Mr. Carpenter, in which a lightning stroke broke through 4½ ft. of masonry to get at a gas pipe, is a case in point. A gas pipe is certainly a bad conductor in the inductive sense and it would be interesting to know the alternative path which it abandoned. Another feature of lightning which is puzzling from any standpoint is the globular variety, which is well attested and yet does not seem to fit any ordinary theory of electric discharge, though the late M. Planté, if we remember correctly, did succeed in simulating it in discharges over semiconducting surfaces. As a purely practical matter, it must always be remembered that in nearly all instances the seemingly eccentric variations in the path of a lightning stroke are very small compared with the total length of the path and hence lose some of their significance, especially as one generally is unable to say whether the variations are of the main stroke or merely branches. So far as lines are concerned, the vast majority of so-called lightning discharges are purely induced effects or mere branches. When the real thing comes along there is mischief doing. Alternative paths to ground are only palliatives at best. Lightning arresters and grounded wires are luckily now and then effective, but the protection they afford is very limited even at its best.

A high factor of safety in the line insulation seems to be the most important consideration, for it enables the line to defy the inductive surges due to the lightning which might break down ordinary insulation. One may assume, for instance, that a large group of such indirect "lightning" phenomena involve no more than 100,000 volts. A line designed for regularly carrying this voltage would probably pass unscathed through storms that would put a 25,000-volt line out of business with the first jolt. One of the most useful things to be done is a systematic study of the actual induced potentials due to lightning discharges with a view of ascertaining the real conditions that must be encountered in carrying electric lines through dangerous territory. It is hard, as experience has shown, to prescribe remedies for unknown ills.

The Latest Central-Station Statistics.

The Bureau of the Census has just issued a preliminary report on the central-station industry of the United States—not including the large amount, however, of lighting and power work done by the electric railway systems. The figures given below are exclusive of Alaska, Porto Rico, Hawaii and the Philippine Islands.

The statistics relate to the years ending Dec. 31, 1907, and June 30, 1902. The totals include central stations only. They do not include isolated plants or plants that were idle or in course of construction.

	1907.	1902.	Per cent of increase.
Number of establishments	4,714	3,620	30.2
Commercial	3,462	2,805	23.4
Municipal	1,252	815	53.6
Total cost of plants	$996,613,622	$504,740,352	97.5
Total income (1)	$175,642,338	$85,700,605	104.9
Lighting service	$125,755,114	$70,138,147	79.3
All other electrical service	$43,859,577	$14,048,458	212.2
All other sources	$6,027,647	$1,514,000	298.1
Total expenses	$134,196,911	$68,081,375	97.1
Salaried employees:			
Number	12,990	6,996	85.7
Salaries	$11,733,787	$5,663,580	107.2
Wage-earners:			
Average number	34,642	23,330	48.5
Wages	$23,686,537	$14,983,112	58.1
Supplies, materials and fuel	$44,458,568	$22,915,932	94.0
All other expenses (including interest on bonds)	$54,318,019	$24,518,751	121.5
Steam and gas engines (including turbines):			
Number	7,674	6,095	25.9
Horse-power	2,684,228	1,392,122	92.8
Water wheels:			
Number	2,474	1,390	78.0
Horse-power	1,347,487	438,472	207.3
Total kilowatt capacity of dynamos	2,642,403	1,218,735	116.8
Output of stations, total kw-hours	5,858,121,860	2,507,051,115	133.7
Estimated number of lamps wired for service:			
Arc lamps (2)	555,921	385,698	44.1
Incandescent lamps (2)	41,807,944	18,194,044	129.8
Stationary motors served:			
Total horse-power capacity	1,649,026	438,005	276.5

(1) Exclusive of income for current used for light and power that was furnished by railway companies, and which is included in the report for street and electric railways.

(2) Exclusive of lamps used by the establishments reporting to light their own properties.

The final report will contain an analysis of the above totals and present detail statistics by States and for other phases of the industry.

Court of Patent Appeals.

The measure for a Court of Patent Appeals which the American Bar Association has been furthering at Washington for the past six years has recently been the subject of hearings before the Committee on Judiciary of the House of Representatives.

The bill provides for a court of five justices, of whom the chief justice shall be appointed by the President and the four others shall be designated by the chief justice of the Supreme Court of the United States from among the judges of the Federal, circuit and district courts. Two of the four judges are to sit for three years each and two for six years, and appointment shall be made for six years thereafter. The bill places the salary of the chief justice at $12,000 per annum and the others will receive additional salary, making a total of $11,500.

Until 1891 the Supreme Court of the United States decided patent cases, and in the course of one of the hearings Mr. F. P. Fish said these decisions were "monumental." The court was relieved of this duty when the Court of Appeals was established, and it is to restore, approximately, the satisfactory conditions prevailing when the Supreme Court was the court of last resort that patent lawyers have been striving for legislation.

One of the prime reasons cited in favor of the proposition was that, in the opinion of Mr. Fish, patent lawyers and patent judges become "bad lawyers and bad judges" when they handle only patent cases. Mr. Fish said that although making a specialty of patent practice he never permitted himself to give his attention exclusively to this class of work, because of its peculiar effect upon his method of thought. It is on this principle that the bill proposes that the patent judges shall be taken from and returned to the circuit and district benches. Mr. Fish cited as an illustration the interesting instance of a very learned and able judge of one of the Federal courts who was also a skilled mechanic, and of whom he said that his expert knowledge of mechanism actually had warped his judicial faculty.

Argenta (Ark.) Municipal Lighting Plant.

The city of Argenta, Ark., put its new municipal lighting plant in service on Dec. 31, on the evening of which there was a reception at the generating station presided over by Mayor W. C. Faucette. The equipment consists of two 250-hp tandem-compound Ideal engines direct-connected to two 150-kw, three-phase, 2300-volt generators, and a 100-kw motor-generator set for the supply of current to the street railway, the voltage being converted by it to 500 volts direct current. The switchboard comprises an exciter panel, two commercial panels, one arc light panel and a street railway panel. The plant was erected by Mr. George F. Brockman, who remains with it as superintendent of light and power. Mr. Brockman has erected a large number of stations in this country and Mexico, including plants at Cold Springs, N. Y.; Quincy, Fla.; Ensanda, Lower Cal.; Wynnwood, Okla., and Jackson, Ala.

Electrical Row in Winnipeg, Man.

A controversy between City Electrician Cambridge, of Winnipeg, Man., and the Winnipeg Electric Railway Company, which has a monopoly of the street car service, commercial lighting and power business of that city, may cost the city some thousands of dollars in increased insurance risks as well as $2,000 for an expert inquiry. The city electrician created a panic by attributing two fires, one of which occurred in a large business block on Main Street, and the other in the Imperial Bank Building, to stray currents from the street railway track on Main Street. This particular track was only completed in 1908, the company using 96-lb. rails double bonded with 4-0 compressed terminal flexible bonds, while there is also a 500,000 circ. mil cable between each pair of rails, and each rail is bonded to this cable in two places. For more than a year past the Winnipeg business men have been trying to secure a reduction in the insurance rates and have installed a high-pressure water service at a cost of over $1,000,000 for this purpose, but this alarm is expected to prevent any reduction of fire risks until next April or May, when Professor L. A. Herdt, of McGill University, reports to the city on the matter. An amusing feature of the scare was the explanation given regarding the cause of the fire in the business block when it was gravely stated that the current might have flowed along a water pipe or lead-covered telephone cable to a metal ceiling and up a hole in the ceiling and set alight the woodwork of the floor. The actual cause of the fire appears to have been a lighted match or cigar stub dropped near a barber's chair through a hole in the floor left by moving back a row of wash basins.

Figures of the Production and Use of Copper.

In a U. S. Geological Survey report by Mr. L. C. Graton, just issued, the world's production of smelter copper in 1907 is set down as 1,589,809,300 lb., of which the United States contributed over one-half, or 868,996,500 lb. Of this American product, 592,326,608 lb. was electrolytically refined, or about two-thirds; Lake copper being 178,534,141 lb. and casting 13,410,678 lb. The direct use by the electrical industries is the largest domestic factor in consumption, being given as 220,000,000 lb., the other items being: Brass manufacture, 150,000,000 lb.; copper sheets, 30,000,000 lb., and castings, 85,000,000 lb.

The above figures do not show, however, the full importance and extent of the electrical refining. It will be seen from the subjoined statement that foreign copper to the amount of 245,000,000 lb. was also electrolytically treated here and that

in fact the enormous total of 845,706,283 lb. was electrical. He says: "The quantity of electrolytically refined copper produced in the United States in 1907 from domestic materials of primary origin was 592,326,608 lb., as compared with 648,614,592 lb. in 1906. This was produced mainly by the refining of blister or converted copper, but 34,917,988 lb. in 1907 and 24,017,833 lb. in 1906 were derived from anodes of Michigan copper refined for purification or for silver content. The year's production of the electrolytic refineries from domestic material of secondary sources was 8,316,861 lb., as compared with 15,382,129 lb. in 1906. Materials of foreign origin electrolytically refined in 1907 in the plants of this country yielded 245,062,814 lb., as against 191,370,022 lb. in 1906. The total output of electrolytic copper by American refineries during the year 1907 was therefore 845,706,283 lb., of which 837,389,422 lb. was from primary sources. In 1906 the total electrolytic production was 855,366,743 lb., of which 839,984,614 lb. was from primary sources. The cathodes resulting from electrolysis are commonly melted and cast, according to specifications of the buyer, into wire bars, ingots, cakes, or other forms.

"In addition to the 845,706,283 lb. of electrolytic copper, the refineries turned out approximately 8,466,630 lb. in the form of bluestone. This quantity of copper, which is about 1.04 per cent of the total copper subjected to electrolytic refining during the year, virtually represents the loss attendant upon this process, and indicates an average recovery of about 99 per cent of the copper received. An average recovery higher than this certainly could be made, and probably would be made if the bluestone were not a product which generally commands a good price and if it did not afford by its formation certain advantages of internal operation, as, for example, the neutralization of excess sulphuric acid in the electrolyte."

Mr. Graton goes into an interesting discussion of the relative merits of "electrolytic" and "Lake," and comes to the conclusion that practically no advantage or superiority whatever remains on the side of "Lake," a term which he regards as out of date and idle. "The old contention as to quality of product between the producers of Lake copper and those of electrolytic copper has recently been aired and apparently settled." As to American production of copper in general, it is shown that the average yearly growth since the industry became important has been 9.9 per cent; but for the past seven years has only been 5.5 per cent.

Failures of Electrically-Welded Rail Joints.

Failures in the electrically-welded joints of railway tracks in city streets, where the rails are practically embedded in the pavement, are so few as to be negligible. This is in direct opposition to the careful teaching of our schoolboy days to the effect that spaces must be left between the rails to allow for the expansion and contraction of the metal due to variation in temperature. But it is to be observed that the rail in the city street, made continuous by welding, is protected from sudden alterations of heat or cold by the fact that only its top surface is exposed to the weather.

In a recent talk before the Electric Club of Chicago, Mr. R. H. Rice, of the Board of Supervising Engineers, Chicago Traction, said that experience with electric track welding has shown a failure of less than 2 per cent of the joints. Of this small proportion of failures nearly all, in Chicago, occurred in outlying streets, where the pavement outside the tracks was insufficient, showing that it is the protection of the rail, rather than any flaw in the old theory, that makes the continuous rail possible.

Apparently the stresses due to expansion and contraction are taken up in the metal itself, and in cold weather, for instance, the rail is undoubtedly in a state of tension. Mr. Rice mentioned an instance where it became necessary to cut the welded rail of a street-railway track to effect some repair. When the workman's saw was within an inch or two of the bottom of the rail the remaining metal was ruptured by the strain, and the severed ends pulled apart for a distance of about 1½ in.

Discussion of U. S. Patent System.

The members of the Chemists' Club, Society of Chemical Industry, American Electrochemical Society, and of the Institute of Chemical Engineers met at the Chemists' Club, 108 West Fifty-fifth Street, New York City, on Friday, Jan. 8, for the purpose of listening to and discussing a number of papers on the general subject of the "U. S. Patent System: Its Use and Abuse." Four papers were read as follows: "Patents: Trade Secrets and Trade Names as Factors in Industrial Development—Their Relative Functions," by Mr. W. Hastings Swenarton; "Some Defects in the Practice of Our Patent System and Suggested Remedies," by Mr. Louis C. Raegener; "Some Suggestions as to Desirable Improvements," by Dr. B. C. Hesse, and "The Inventor's Standpoint," by L. H. Baekeland. Prior to the reading of the papers, Mr. F. I. Allen, past Commissioner of Patents, made some introductory remarks of a historical and descriptive nature.

None of the authors had any fault to find with the present patent system. Indeed, judging from the tenor of their remarks, there is little to be desired in the way of change in the Patent Office itself. This attitude, so much at variance with the opinion of most inventors, may possibly be partly accounted for by the fact that two of the speakers are patent attorneys and a third has taken patents out in other countries where the expense is greater, the time shorter, and where the inventor is compelled to work his patent. Dr. Hesse suggested that an annual tax be placed on all patents. The tax should not be large enough to prove a hardship to patentees who have put their patents into use and would act as a deterrent to worthless patents and others got out for exploitation purposes.

All of the speakers, however, were agreed that the present practice and procedure of trying a patent case are antiquated, time-consuming, abnormally expensive and generally unsatisfactory. Final judgments are practically unobtainable and pecuniary judgments are so rare that any well-advised infringer need hardly fear them. Mr. Raegener, speaking from an experience of many years as a practising attorney, said that the burden of proof rested on the complainant, and added the rather surprising statement that the law very jealously protects the poor infringer against injustice. He cited the fact that there are nine Circuit Courts of Appeal and that the law in a certain circuit is not necessarily the law in another circuit, so that it is not uncommon for judges to reach diametrically opposite conclusions on identical cases. The result is that an injunction sustaining the validity of a patent is only good in the district over which the Circuit Court has jurisdiction. No appeals from the Circuit Court of Appeals lie to the United States Supreme Court, although one may petition the latter court to review a decision. The United States Supreme Court will, however, not grant such petitions unless some matter of wide public importance is involved. With the integrity of the judges Mr. Raegener finds no fault; but their capacity and ability in patent cases, he says, are as varied as the colors of the rainbow. The patent lawyer, in Mr. Raegener's estimation, is inexperienced and careless who does not carefully select his tribunal so far as this is possible. As to the possibilities of remedying the defects noted, he cited the method of trying cases in England and in Germany. In the former, patent cases are tried in open court and the successful party recovers, say, two-thirds of the price paid to lawyers and experts. In the latter country, the patent is valid after five years, and during the five years is virtually valid unless a procedure is brought during that period to vacate the patent. In neither country are there numerous courts having jurisdiction. The testimony in patent cases, Mr. Raegener said, should be taken before judges who could apply the rules of evidence at once and thus get rid of all padding of the records.

The discussion of the topic was very short. One speaker pointed out the marvelous grasp of the legal mind on difficult and intricate subjects displayed at times by judges in patent cases, and another said that Bill No. 21,455 creating a United States Court of Patent Appeal is at the present time before

Congress and will doubtless be passed. He suggested, however, that everyone interested should impress the Senator or Congressman of his district with the desirability of such legislation so as to leave no question as to the need of such a court.

Stability in Electric Lighting Circuits.

Professor Elihu Thomson presented a paper entitled "Conditions Affecting Stability in Electric Lighting Circuits" at the meeting of the American Institute of Electrical Engineers held on Jan. 8. The paper dealt chiefly with constant-current series circuits containing arc lamps operated either by direct-current generators, by alternating-current transformers, by reactive devices in alternating-current circuits or by rectified alternating currents from transformers. The instability in such circuits is attributable to that property of the arc which results in its resistance decreasing with increase of current.

Professor Thomson traced briefly the history of the development of constant-current generators, and explained the methods employed for insuring stability. In the Thomson-Houston arc-lamp machine stability was secured by using saturated field cores made of iron of high retentivity and by arranging the pairs of brushes on the three-part commutator so as to obtain a certain restricted arc of contact between adjacent segments. In the Brush arc-lamp generator the stability was due largely to the proportioning of the proper extent and relative sections of the pole horns adjacent to the armature on each side; the drooping voltage-current characteristic also has considerable effect upon the stability.

In the constant-current transformer, the general impedance of the system, including the lamp magnets, results in a full potential with increased current at a rate sufficient to insure stability. The development of the mercury-arc rectifier and its apparent special adaptability to the rectification of small currents at high voltage has naturally led to its employment in conjunction with constant-current transformers for securing direct current suitable for series-arc circuits. Instability may be caused under certain conditions by too high or too low a temperature in the rectifier, change of vacuum, or momentary flashing from anode to anode. Control of the working temperature has been obtained by oil immersion, which has proved very satisfactory. Professor Thomson stated that some mercury-arc rectifiers now in service have been used over 5000 hours.

Prior to the general discussion of the paper, communicated discussions were read from Dr. A. E. Kennelly and Mr. Alexander Dow. Dr. Kennelly pointed out that while the method of ballasting the circuit with extra impedance is especially applicable to constant-potential circuits, although wasteful of power, the method of providing the generator with a drooping, external characteristic is especially applicable to constant-current circuits. The problem of restoring stability, he said, was complicated by kinetic actions, such as the time interval of arc-mechanism response, of engine-governor response, of field-magnet response, etc., so that even with the accumulated experience of 30 years, the problem as presented in a series arc circuit is very complex. He called attention to the fact that the property of diminution in resistance with current is utilized in wireless telephony to throw a vertical conductor into sustained electric oscillation, by means of voltaic arcs shunted by condensers.

Mr. Alexander Dow related some interesting experiences with arc machines, as did Mr. E. W. Rice, Jr., who told of how he arranged a lamp as a super-sensitive stability regulator for a number of arc lamps placed on exhibition in Boston in 1882. He also told of his experience with the short-circuit band of copper around the field core parallel to the windings. Prof. D. C. Jackson spoke of the characteristics of the old Wallace arc lamps with plate electrodes of gas-house carbon and also of the contest between the short or hissing arc and the long or silent arc prior to the introduction of the Brush or Thomson dynamos. The former he said was looked upon as a curiosity, while the latter was charged with being a monstrosity. Both machines, however, proved their right to exist. Prof. Jackson looked upon the function of the blower somewhat differently than did Prof. Thomson. The Thomson-Houston machine, he said, shows an obvious blowing out of the arc, which, however, is not like the blowing out of a candle where the flame is blown from the wick by a blast. The air blast crosses the path of an arc existing between commutator segments, stretches it to the point of rupture and replaces the heated gases by air which is cool and unpolarized, and therefore will not support a renewal of the arc until it is re-established by the action of the brushes.

Mr. C. M. Green, who has been connected with the later development of the arc machine, gave the results of some earlier observations of the effect of armature reaction, which in his opinion is the keynote of all arc machines. Under poor load conditions, the point of commutation is on the following pole piece and as the load is decreased or the lamps cut out, the point of commutation goes still further and further on to the following pole piece. The regulation of the various arc machines is accomplished in different ways. In the Thomson-Houston and Ft. Wayne machines the final adjustments on regulation are accomplished by means of varying the armature reaction; by overlapping the brushes in the Thomson-Houston machine and by separating them in the Ft. Wayne machine. In modern arc machines there are no short-circuited bands around the field coils; the voltage per commutator segment is as high as 3000 without an air blast and with laminated pole pieces and the temperature rise instead of being 270 deg. C. above the surrounding air as heretofore, is only about 11 deg. C. Saturation of the iron, he considers to be one of the most essential features for stability in the operation of the machine, in fact Mr. Green doubts if there is any other machine manufactured having a higher saturation of the iron than the Brush arc machine. Generally speaking, arc machines do not operate well at reduced currents and their kw-load is reduced practically in proportion to the scope of the current. It is considered true that as arc generators are loaded, the brushes go forward; but in constant-current apparatus, the brushes go backward. The polarity of the direction of current flowing in a Brush arc generator or Thomson-Houston machine can be told from the nature of the spark on the commutator. The spark on the negative brush has a regular worm form tapering down, only on the horizontal brush it has a straight line running through it.

Mr. J. B. Taylor called attention to the stability of illumination, stating that while there might be a steady current in the arc, the latter may wander from one side to the other of the electrode. It seemed to him that in some of the underground cable systems for arc lamp circuits there was a condition not unlike that made up on purpose for the singing or oscillating arc in high frequency service. The capacity of the cable is around in the arc in series with more or less reactance in the lamp mechanism.

Dr. C. P. Steinmetz showed that the unstable electric circuit discussed in Prof. Thomson's paper has a significance far beyond the arc circuit. While the electric arc is the best known example of unstable electric circuits, instability occurs in other electric systems. Synchronous and induction motors drop out of step; such motors often start and fail to run up to speed; there is surging and hunting of synchronous converters; electric apparatus at the end of every long transmission line acts strangely, etc. The reasons for these phenomena were explained by Dr. Steinmetz, who also considered the question in various other lights. He drew attention to one feature not brought out and that is the constancy of current of the Brush arc machine regardless of the speed. In a constant-potential generator the voltage fluctuates more than the speed. In the Brush arc machine the current remains the same until the machine stops. Even when it is just slowly turning over, full current still exists. Dr. Steinmetz also spoke of the characteristics of the early Stanley arc machine. Going minutely into some characteristics of the arc and mercury arc, he showed how some of the principles were employed for lightning protection.

Work of the Engineering Staff of Wisconsin Tax and Railroad Commissions.

A paper on the "Work of the Joint Engineering Staff of the Wisconsin Tax and Railroad Commissions" was read before the Western Society of Engineers, Chicago, on Dec. 16, 1908, by Prof. William D. Pence, engineer of the two commissions and professor of railway engineering, University of Wisconsin. The most important work done by the staff is the valuation of the physical property of public utility corporations. Recent valuations comprise the properties of 52 steam railroads, 24 street and interurban railways, with 10 associated lighting and heating properties, and 24 public utility plants. The cost of reproduction of all of these properties was ascertained to be as follows:

Property, new, $277,318,009; present condition, $222,887,929. The values fixed for the street railways (with the associated lighting and heating properties) and the public utilities properties were as follows:

	Cost of reproduction.	
	Property, new.	Present condition.
Street railway properties	$26,783,620	$21,208,010
Public utilities properties	6,405,521	5,440,605

Under the law providing for the supervision by the Railroad Commission of the capital issues of public utility properties five properties have been valued and the following results determined: Property, new, $305,576; present condition, $270,008.

Professor Pence described the organization of the staff in 1903 under authority of the law providing for assessment of steam railroad properties, and the subsequent changes under later laws affecting street railway and other utility properties.

"The 1905 law prescribing the ad valorem basis of assessment for street railroad properties provided for the valuation work to begin," Professor Pence said, "on the initial inventory data of June 30, 1907, but the work was actually undertaken some six months earlier than that date because of a complaint lodged with the Railroad Commission respecting street car fares in Milwaukee. To meet this emergency the staff was reorganized and greatly extended in January, 1907, and since that date a staff of from 20 to 30 members has been required continuously to meet the joint demands of the two commissions."

The working organization of the staff includes the following subdivisions: (1) Administrative, (2) office staff, (3) civil engineering staff, (4) mechanical engineering staff, (5) electrical engineering staff, (6) gas engineering staff, (7) gas and electric service inspections, and (8) miscellaneous. Professor Pence outlined the organization, and the following details indicate the scope of the work of two of the groups:

"Electrical Engineering Staff.—Engaged in the inspection and valuation of those details of the physical property of steam and electric railways and public utilities plants which are usually constructed, purchased or operated under the direction of electrical experts or engineers, including electrical machinery and appliances in power plants and elsewhere; electric railway rolling stock; electrical distribution systems, overhead and underground; telephone plants; signaling appliances; tools, stores and supplies related to the above items, etc. Also investigations, in co-operation with other departments, with a view to suggest improvements in the operating conditions of electric railways, power plants, telephone properties, etc.

"Gas and Electrical Service Inspections.—Engaged in inspections and investigations of gas and electrical service; studies with reference to the establishment and revision of standards of service and the formulation of rules for the same; tests and calibrations of instruments used in service measurements; investigations with reference to the electrolysis of water and gas mains, etc. Also investigations, in co-operation with other departments, with a view to suggest improvements in the operating conditions of gas and electric plants."

In speaking of the qualifications for membership on the staff and of the preponderance of technical graduates employed, Professor Pence said:

"Membership on the staff is based upon ascertained fitness for the special service for which the appointment is made. There is entire freedom from political or other influence both in the matter of appointment and in the tenure of position on the staff.

"The present membership of the technical staff consists almost exclusively of graduates of engineering schools, and about 60 per cent of the permanent staff are graduates of the University of Wisconsin. Seven members of the regular staff are also members of the faculty of the College of Engineering, University of Wisconsin, among this number being the engineer in charge, the chief mechanical inspector and the expert on light and heat. Five other members of the teaching force of the engineering college also render occasional service on the commissions' staff. It is proper to say in this connection that this is but one of many instances in Wisconsin of active participation by university men in professional service on behalf of the State. Such participation is encouraged by the board of regents and president of the university both on account of a recognized obligation to the State which provides support, and because of the stimulus given to the work of the university through outside contact of this kind."

Regarding the methods followed in making valuations Professor Pence said:

"The valuations reported to the commissions by the engineering staff have been confined throughout to the physical property, without regard to intangible elements. For a given inventory covering the items of any particular property, a definite value is fixed upon a fair basis as to unit prices, etc., and the results are reported by the staff at a definite amount, irrespective of the uses to which the figures are to be applied. These determinations are, by intention, entirely free from bias. Every reasonable effort is made to get at the exact truth in regard to local conditions. The figures are subject to revision upon finding evidence of defects of inventory, errors of judgment or other element likely to vitiate results. After submitting the valuation reports to the commission opportunity is given for further conference and hearing upon any or all items of the physical valuation.

"In certain public utilities cases the owners, and in a few cases the cities as well, have employed experts to give testimony on values before the Railroad Commission. In one or two such cases the State engineering staff has submitted to the representatives of the utilities company and the city an 'informal' valuation report to serve as a basis for preliminary conference and discussion. This preliminary report, after due consideration in the light of added data and information, is succeeded by the 'tentative' valuation report which is submitted to the Railroad Commission as a part of the formal record in the case to be considered with other evidence. Before making up a final decision in the case the commission gives the engineer an opportunity to review the record and submit a supplementary report, in which are presented revisions or comments bearing upon the original or 'tentative' valuation report."

In the valuation of the Milwaukee street railway properties a staff of 23 persons was employed, Mr. Bion J. Arnold and Mr. George Weston, of Chicago, assisting in the work. The final report included the entire property owned by the Milwaukee companies, known locally as the "Beggs properties," viz., the city railway lines (123.6 miles) and the associated lighting properties (The Milwaukee Electric Railway & Light Company), the country or interurban railway lines (144.2 miles) and the associated lighting properties at Racine and elsewhere (Milwaukee Light, Heat & Traction Company), and the Milwaukee steam heating company (Milwaukee Central Heating Company). The total physical valuation, including all the properties mentioned above for the inventory date of Dec. 31, 1906, amounted to $18,435,960 for the property new, and $14,864,849 for the property in existing condition.

Of additional electric railway lines which were valued about one-half are operated in association with public utility properties supplying electric lighting and power service.

Professor Pence said that the methods now employed by the engineering staff in the valuation of the physical property of

public utility plants are in many respects in close agreement with those adopted early in 1907 for the valuation of the electric railway properties of the State for the joint purposes of the two commissions. These methods in general embrace:

1. The preparation of a detailed descriptive inventory.
2. Field examinations of the property by a trained staff.
3. Determination of the "cost new" of each item.
4. Estimation of the depreciation on each item of property.
5. Calculation of the present value.
6. Summing up the detailed valuations by groups.

An abstract of the portion of the paper which refers to the valuation of public utility plants follows: "As an initial step in each important utilities valuation it is customary for the commission's engineer to hold a joint conference with representatives of the company and the city.

"The preparation of preliminary inventories or descriptive check lists of the properties has been entrusted to the responsible officials of the public utilities companies wherever practicable.

"The field examinations of the physical property begin with a careful checking up of the inventory. Throughout the progress of these field investigations due consideration is given to the fact that the public utilities law provides for periodical revaluations of each property examined, necessitating a permanent record from the very start. This view of the situation, coupled with the rate-making feature, has naturally led to an open-minded attitude on the part of the commission's staff and of the interested parties with respect to rectifying any discrepancies discovered in the descriptive record.

"With a view to establish a definite and reliable basis for fixing costs, extensive investigations have been made relative to existing commercial conditions, with the result that a vast amount of cost data as to the purchase and installation of the various kinds of physical property embraced in the public utilities plants is now available in the confidential records of the engineering staff. This information has been gathered from many sources, one of the most important of these being the actual contracts and other records of costs kept in the offices of the various public utilities companies of the State.

"The records of the utilities companies are made available to the commission or its authorized agents by the terms of the public utilities law. These records, combined with the confidential quotations and cost data of many kinds supplied through direct solicitation by manufacturers throughout the country, provide a substantial basis upon which the unit costs are kept up to date. In responding to the requests for information, the manufacturers in a number of instances have found it necessary to carry on considerable research work. In such cases it has been the practice to offer to defray the necessary clerical expense involved in compiling the desired information. In but few instances, however, have these offers of reimbursement been accepted. The invaluable assistance thus extended by the manufacturers is believed to have resulted not only from their being frankly and fully informed at the outset as to the special purposes for which the information would be employed, but also because of their desire to co-operate in an important public movement based primarily upon substantial justice to all concerned. It scarcely need be said that the figures obtained from manufacturers are treated as confidential and used only for the specific purposes for which they are solicited.

"It should be stated in this connection that the utilities companies of the State have shown but little disposition to interfere with this free co-operation on the part of the manufacturers. In the very few instances where such interference has actually been noted, the utilities officials have usually been quick to respond to the suggestion that such action was not only short-sighted but also in direct violation of the spirit of fairness pervading this entire matter. In like manner, citizens and officials of certain cities of the State where a feeling of antagonism had previously developed against certain public utilities companies have in a number of instances desisted from what seemed to be an effort to withhold essential facts required by the engineering staff.

"In addition to the sources of information above referred to the members of the staff have been able to supplement their personal records of cost data through many voluntary contributions from the professional notes of prominent engineers and by figures gathered from publications of technical societies, the columns of trade and technical journals, etc. Reference may also be made to the accumulation of valuable data included in the sworn testimony given by experts at the formal hearings of the commission.

"In order to avoid extreme variations in unit prices due to the fluctuations in market quotations and also with a view to approximate as closely as practicable the conditions which usually prevail in building up public utilities properties, it has been the practice of the staff to use average prices for a term of years rather than to apply the current quotations or unit costs prevailing at the actual date of inventory. For this purpose the average price for the five-year period immediately preceding the date of valuation has been used whenever in the judgment of the staff such rule was practicable.

"In determining the allowance to be made for depreciation in value due consideration is given by the staff to the actual condition of each machine or other item of the property, taking into account the age of the device in connection with its probable ultimate efficient life, the character of the service, the standard or quality of maintenance, and such other elements as may aid in reaching a reliable judgment in the matter. In the steps leading up to such final conclusions, accumulated experience with reference to closely similar property, maintained to a like standard and operated under indentical or similar conditions as to service, etc., receives due consideration. An individual item of physical property is judged with reference to its agreement with or departure from the average of such related group or class of property in fixing the probable useful life and in estimating the depreciation. Results obtained by this method in the valuation of physical properties of Wisconsin railroad and public utilities companies aggregating many millions of dollars have established the trustworthiness of the method here described.

"The depreciation percentage is customarily applied against the net or service value found by deducting the scrap or residual value from the 'new value,' and the so-called 'present value' is determined in the usual way by combining the scrap value and the depreciation service value. The treatment of scrap values has perhaps been carried somewhat beyond the degree of refinement customarily used by most engineers engaged in water works and other like appraisal work, although, it is believed, not beyond what is consistent and proper, considering the magnitude and permanence of these Wisconsin valuations. However, undue refinements in this respect are guarded against, and in cases where the scrap value is slight or much in doubt, the depreciation percentage is applied directly to the cost new to determine the present value."

Different schemes of classification are used in the reports of tentative valuations of different classes of single or combined utility properties. The following, for combined electric railway and light properties, indicates the scheme:

1. Land (right of way and other).
2. Track and track structures.
3. Cars and car equipment.
4. Electrical distribution system.
5. Power plant equipment.
6. Buildings and miscellaneous structures.
7. Office furniture and appliances.
8. Tools, implements, etc.
9. Horses, wagons and miscellaneous.

Total of items 1-9.

10. (See note below.)

Total of items 1-10.

11. Stores and supplies.

Total of items 1-11.

12. Paving.

Total of items 1-12.

Note.—Group 10 is the addition of a percentage to cover engineering and supervision, interest during construction, contingencies, etc.

"It was early seen," Professor Pence said, "that the proper

administration of the law would necessitate the establishment of a central laboratory equipment for the purpose of investigating the various kinds of public utilities service, with a view to the fixing of legal units and standards and also to putting the same into practice on a permanent and uniform basis throughout the State. After some preliminary discussions and conferences arrangements were made whereby the laboratory facilities of the University of Wisconsin were made available for the purposes of the Railroad Commission, with the understanding that there should be reciprocal use of the instrumental equipment to be purchased subsequently by the commission."

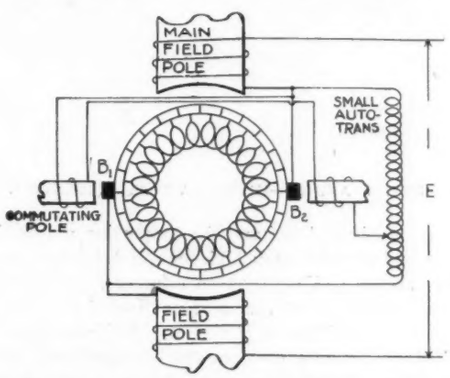
After some progress had been made in investigation a general conference or hearing was held (March, 1908) at which the owners and operating officials and experts of the various gas and electric companies of the State were given an opportunity to express their views.

After giving consideration to all available information the commission formulated a set of rules governing standards for gas and electric service which were officially adopted on July 24, 1908, to become effective three months thereafter.

Commutation in Alternating-Current Series Motors.

In a paper presented before the Worcester Polytechnic Institute Branch of the A. I. E. E. on Jan. 8, Dr. A. S. McAllister outlined the difficulties relating to commutation encountered in alternating-current series motors. These difficulties are not attributable to the alternation in the armature current, but are caused by the rate of change in the field flux. There is produced in the armature coil under the brush by transformer action an active e.m.f. which in a large 25-cycle motor would usually reach a value of from 6 to 20 volts. It is the rupture of the current produced by this e.m.f. that causes the vicious sparking in the plain alternating-current series motor.

Although no simple methods have been devised for eliminating this e.m.f. under starting conditions, many effective schemes



ALTERNATING-CURRENT COMMUTATOR MOTOR WITH SHUNT-CONNECTED COMMUTATING-POLE WINDINGS.

are now employed to neutralize it under running conditions, and the resistance-lead method of minimizing the current produced by this e.m.f. under both starting and running conditions has proved absolutely satisfactory.

The best arrangement for eliminating the transformer e.m.f. under the brush is one involving a construction similar in all important details to that of the direct-current interpole motor. However, the method of obtaining the desired result differs in one important detail: instead of connecting the coils on the interpoles in series in the armature circuit, they are joined in parallel with the armature in such a way as to allow the e.m.f. impressed upon these coils to be decreased as the speed is increased.

A convenient arrangement by means of which the cause for sparking can be entirely eliminated under speed conditions is indicated in the accompanying diagram. The flux in the commutating poles is in time-quadrature to the main field flux, and hence the speed-generated e.m.f. in the coil under the brush is in time-phase (opposition) with the e.m.f. generated in the same coil by the transformer action of the main field flux. The e.m.f. on the commutating pole coils should be caused to vary directly with the value of the main field flux and inversely with the speed of rotation; this condition can readily be obtained by means of the auto-transformer. For the purpose of improving the power factor it is desirable to place on the field core a compensating coil conductively associated with the armature; this feature is not essential to perfect commutation, and is not shown in the illustration. By connecting resistance in parallel with the main field winding the power factor may be increased to unity, or the motor may be caused to draw leading (condenser) wattless current from the system.

Boston Edison Employees' Lecture Course.

The opening lecture of the course on electrical engineering which Prof. Sydney W. Ashe has been engaged to give before the employees of the Boston Edison Company was delivered Jan. 7. There is every indication that this course will prove the most popular and be the most largely attended of any feature that the Boston Edison Employees' Club has ever planned. The meetings were attended by over 250 men, and additional applications are being made for tickets. The plans for this course of lectures received the serious consideration and hearty support of the officers of the company.

It has been so arranged that an afternoon lecture accommodates those employees whose hours prevent their attendance in the evening, and there was an unexpectedly large number present at the first meeting Thursday afternoon. The larger attendance will naturally come at the evening meeting, held at 7 o'clock. All the lectures are given in the large auditorium and library in the Edison Company's new building at 39 Boylston Street, in Boston. This room was designed with special reference to the convenience of employees of the company, and is fitted with ample seating arrangements for lectures and other semi-public gatherings. There is a large stage at one end and long, broad tables provided for employees who wish to use books from the library.

Members of the Edison Employees' Club are admitted on payment of $1 for a course ticket. Employees of the company who are not members of the club are admitted at $2 each for the course, while those who are interested in the subject but are not connected with the company may attend on payment of $3 for the course.

Third Annual Meeting of the Illuminating Engineering Society.

About 65 members of the Illuminating Engineering Society gathered at the Machinery Club, 50 Church Street, New York City, on Friday evening, Jan. 8, to attend the annual meeting of the society, which was preceded by an informal dinner. At the speakers' table were Dr. Louis Bell, president; Mr. W. H. Gartley, president-elect; past presidents Mr. C. H. Sharp and Mr. L. B. Marks; Mr. V. R. Lansingh, secretary, and Dr. A. H. Elliott, treasurer.

Dr. Bell's presidential address dealt largely with the present status of the society. He noted with much satisfaction that the members of the organization were gradually making a serious and dignified profession of illuminating engineering and were gaining for the art and science the recognition of both the technical and lay public. Gratifying, and even remarkable, progress had been made during the three years of the existence of the society, but this served only to show how far illuminating engineering was from the goal of its ambition. The work for the year had been marked by a gratifying unity of effort among the diversified interests represented in the society's membership, and by a feeling of good fellowship among the members, which had been enhanced by the generous publication of engineering data on the part of certain members who had presented papers.

Reports covering the year's work were presented by various

committees. In particular, the treasurer's report was gratifying in that it showed the financial affairs of the organization to be in a very satisfactory condition—far more so than during any of the previous years. It was taken as a most encouraging omen that a society whose membership dues are only $5.00, and which place in the hands of each member monthly transactions, can get through the year with a satisfactory cash balance on hand.

The report of the committee of tellers, appointed to count the ballots in the election of officers for 1909, was read. The following officers were elected: President, Mr. W. H. Gartley, Philadelphia; vice-presidents, Mr. Charles O. Bond, Philadelphia; Mr. J. S. Codman, Boston; Mr. George C. Keach, Chicago; secretary, Mr. Preston S. Millar, New York; treasurer, Dr. A. H. Elliott, New York. Directors: Dr. A. S. McAllister, New York; Mr. G. Ross Green, Philadelphia, and Mr. E. N. Wrightington, Boston.

President Gartley immediately took the chair and addressed the society briefly. To his mind the danger to be guarded against during the coming year was apathy on the part of those members to whom the association must look for a large part of its advancement. Some of the interest which was aroused by the enterprise when it was new might wane, now that the society is established on a permanent basis.

President Gartley stated that the proposal had been made to the council that consideration be given at this time to the classification of the membership into active and associate members, and called for expressions of opinion on the subject for the guidance of the council. After considerable discussion, which evidenced anything but unanimity of opinion on the part of the membership, it was voted that the president be requested to appoint a committee to consider the matter of possible classification of membership, and report to the council.

Chicago Electrical Show.

One of the features of the Chicago Electrical Show, which is to be held at the Coliseum, Chicago, Ill., from Jan. 16 to Jan. 30, will be an exhibit of the United States Navy, which will occupy the entire Coliseum annex and consist of a complete electrical equipment of a modern battleship. During the show representatives of the United States Navy will be in attendance at the exhibit to furnish information desired in relation to the electrical equipment of war vessels, which service will be of value relative to the submitting of bids and the furnishing of electrical equipment for the navy.

Tuesday and Wednesday, Jan. 26 and 27, will be known as telephone men's day at the show. On Thursday, Jan. 28, there will be a reunion of former Thomson-Houston electric men, at which anyone who was ever connected with the Thomson-Houston Electric Company will be an honored guest. It is announced that Weber's band has been engaged to furnish music at the Coliseum during the entire show.

Electric Furnaces.

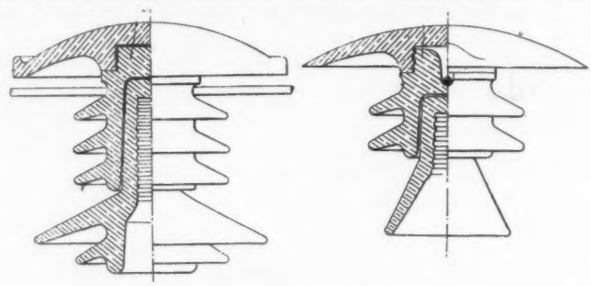
In the ordinary manufacture of silicon carbide, a mixture of silica and carbon is subjected to heat in an electric furnace, the heat being generated by a passage of current through a resistor. At the beginning of the heat the temperature of the resistor and the charge mixture is substantially that of the surrounding air and the whole mass must be raised to a high temperature before the reaction begins. In heating the charge up to this critical temperature, a large amount of electric energy is required and the expense may be large. In order to decrease the cost of operation, Mr. Frank J. Tone, according to a patent issued Dec. 29, 1908, proposes to utilize the heat of combustion in initially bringing the mixture up to the reacting temperature. Heated gases are passed through the charge of sand and coke in which the heating resistor is embedded. In order to support the combustion use is made of an amount of coke in excess of that required for the formation of silicon carbide.

A method of producing silicon free from silicon carbide was patented by Mr. Henry Noel Potter on Dec. 29. The inventor states that fluid silicon does not dissolve carbon, but does dissolve silicon carbide. He proposes to maintain the silicon in a fluid state in contact with silicon dioxide under fluid silicon. According to one arrangement, use is made of an electric arc furnace having vertical coaxial electrodes, the lower one being surrounded near the arc by a bed of silica upon which surrounding the arc is a mixture of silicon dioxide, silicon carbide and oxygen, approximately in the proportions of 62.4, 31.4 and 6.2, respectively. It is claimed that an output of 50 grams of silicon can be obtained per kw-hour of energy expended.

A patent issued on Dec. 29 to Mr. P. L. T. Héroult discloses means for improving the stuffing-boxes for electrodes of an electric furnace. The stuffing-box is provided with a packing of loose graphite, the shape being such as to facilitate the feeding of the electrode through the packing. The graphite serves as the conductor for conveying the current to the electrode.

Umbrella-Type Insulators.

The chief point to be kept in view in designing insulators for very high voltages is to avoid superficial disruptive discharges, especially when the insulators are exposed to heavy rains. The outer petticoat, on the top of which the conductor is secured, extends outwardly to a considerable extent to protect the smaller and lower petticoats from water. When the upper petticoat has got wet, its potential is the same as that of the conductor, wherefore its upper surface is quite inefficient from the point of view of insulation. Moreover, the water drops, falling down from the upper petticoat, when succeeding each other at short intervals, offer an easy path to the disruptive discharges between the



FIGS. 1 AND 2.—UMBRELLA-TYPE INSULATORS.

edge of the petticoat itself and the supporting pin or the cross-arm. For the above reason high-tension insulators usually are very large and very difficult to manufacture.

According to a United States patent issued on Dec. 8 to Mr. Guido Semenza, of Milan, Italy, the different tasks are accomplished by different parts of the insulator and the troubles depending upon the rain are obviated so as to afford an insulator the efficacy of which against external disruptive discharges is claimed to be almost as high in wet as in dry weather. This result is attained by making the insulator of two distinct parts; the lower one, which is the insulator proper, is intended to support the conductor and does not require any outwardly extending upper petticoat; the upper part, which is termed the cap, is secured above the insulator proper and may be formed of any insulating material whatever as it is intended only to protect the lower petticoats of the insulator proper from rain, rendering the water drops dripping from said upper cap innocuous.

Figs. 1 and 2 show two arrangements. According to Fig. 1 the spigot-shaped top of the insulator proper is fitted with screw threads for securing the cap thereto; a lower circular recess is intended to receive the conductor, if it is to be tied to the insulator laterally. According to Fig. 2 the top is fitted with a central recess wherein the conductor rests, in the case of central tying being resorted to.

The following advantageous features are claimed for the above arrangements:

(1) The cap has no insulating function, so as to allow of its

being composed of a material of low dielectric rigidity, while its size, even if very large, does not give rise to special difficulties of manufacture as is the case with the large petticoat insulators now in use.

(2) The water dripping from the cap does not come into contact with the conductor and does not, therefore, render the superficial disruptive discharges easier.

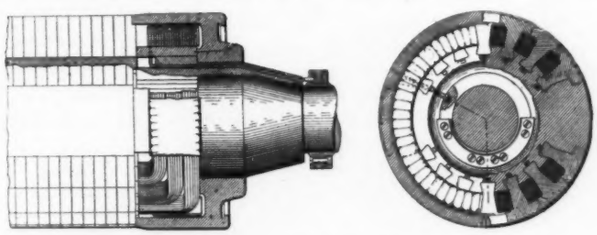
(3) The gutters prevent the water from the cap dripping on the conductor. The latter, therefore, receives only the direct rain, which, owing to the conductor having a certain sag, follows the same up to a certain extent before leaving it.

(4) The petticoats situated below the cap are completely protected thereby and will therefore remain dry.

It is said that the insulator proper may henceforth be made much smaller and its manufacture will prove much easier and cheaper than is the case with the present types.

Field Core for Turbo-Alternator.

The accompanying illustrations show a type of rotor construction for turbo-alternators for which two United States patents were issued to Mr. Karl Sulzberger, of Charlottenburg, Germany, on Oct. 27. The arrangement is such that "framed" coils may be conveniently secured to the rotor even when the opposite turns of coils are separated by many degrees of arc, while the finished rotor presents a smooth external surface. Dovetailed grooves are cut in the core body for holding in



FIGS. 1 AND 2.—FIELD CORE FOR TURBO-ALTERNATOR.

place certain sets of blocks that are inserted after the coils have been laid upon the core. In assembling the rotor, the windings are placed upon the core body with each coil side resting on the appropriate ribs between the ends of the coils, and projecting beyond the end of the core a distance equal to or greater than the thickness of each block. The blocks are inserted radially in the space between the end of the core and the inner end of the end connections of the coils and then moved axially into place.

Manufacture of Tungsten Filaments.

A patent was issued Jan. 5 on the manufacture of tungsten lamp filaments to Anton Lederer, of Vienna, who has been associated with Auer Welsbach in the development of the osmium and tungsten lamp. The application of the patent was filed April 3, 1906. The process consists in mixing with an oxide of tungsten and carbon a small percentage of finely divided aluminum or magnesium which mixture upon the passage of an electric current through the filament becomes reduced to a relatively pure tungsten. It has been shown by Moissan that the oxides of aluminum and magnesium are volatile at high temperature, and it follows that when these materials are exposed to the heat of incandescence, they will be volatilized after having been converted into their oxides in the process of treatment. For best results about 0.1 to 0.5 per cent of finely divided aluminum or magnesium are added to the tungsten oxide and carbon paste.

Another patent was issued on the same date to Hermann Zerning, of Halensee, Berlin, Germany, on a method of decarbonizing metallic filaments, such as the tungsten filament. It is stated that it is necessary to obtain the finished filaments as free from carbon as possible, because a small quantity of carbon influences considerably the resistance or strength and usefulness of the filaments. The invention consists in decarbonizing the filaments by means of nitrogen gas or nitrogenous gases produced by the action of phospham (PN_2H), with or without an addition of phosphorus, in a vacuum. The nitrogen contained in phospham passes off at a relatively low temperature and forms, in a free state, with the carbon, cyanogen or oxide compounds of the same. The phosphorus which becomes free simultaneously is able to combine with the oxygen still present or to exert its reducing action on the metal oxide impurities which may still be present in the filament. The phosphorus is of special importance if the filament contains a considerable quantity of oxygenous impurities. The amount of phospham depends on the nature of the binding agent and is larger according as this agent contains more carbon. Where tar is employed as the binding agent, the proportion of phospham in the finished paste amounts to 4 per cent. The action described takes place immediately when the filament is made incandescent in a vacuum, which then becomes absolutely free from carbon. Another process is described wherein the filaments are treated in quantity in a furnace in which a vacuum is produced, and still another in which the filament is decarbonized after it has been inserted in the bulb of an incandescent lamp. In this case powdered phospham is mixed with alcohol and applied to the filaments or a phospham paste is placed for evaporation on the filament supports; or the phospham may in this case be located outside in a space connected with the lamp.

Controlling Admission of Sound to Transmitters.

An apparatus for controlling the admission of sound to transmitters has been patented by Mr. A. Dare, of Philadelphia. The base of the mouthpiece is a cylinder completely filled with parallel small tubes. Upon this slides a hollow cone, having a row of holes through its wall. The front of this cone is closed by a bank of small tubes, and the mouthpiece shaped to fit the face of the user is outermost. The volume of tone reaching the diaphragm is varied by changing the gap between the opposing ends of the small tubes.

CURRENT NEWS AND NOTES.

NEW YORK ELECTRICAL SOCIETY.—The next meeting of the New York Electrical Society will be held at the Engineering Societies' Building, 33 West Thirty-ninth Street, New York, Wednesday evening, Jan. 20. Dr. J. F. Kelly will address the meeting on the subject of "The Development of the Electric Piano Player."

TROLLEY STORAGE BATTERIES.—The newspapers have had a good deal to say lately about the adoption of Edison storage batteries for New York street cars, notably the Third Avenue line. There has, in reality, been some discussion of such projects, and Mr. Edison has been approached on the subject by responsible persons. At the same time, it must be noted that these statements are decidedly anticipatory. An official comment from Orange is as follows: "Mr. Edison does not care to have any statement made with regard to the battery. When he is fully satisfied himself that everything is all right, he will let the public know."

CABLE RATES.—Vice-President Ward, of the Commercial Cable Company, has addressed to a committee of the New York Board of Trade and Transportation an argument as to the agitation for lower cable rates. He points out that the existing cables have all they can do to take care of the "peak of the load" during the short international business hours, and this is what makes maintenance high. Less than 1 per cent of the public use the cables, and when rates were reduced to 12 cents per word, the increase in volume of traffic was only 10 per cent during the two years and four months and receipts were diminished nearly one-half. Business was done at a loss and restoration of rates to 25 cents was an absolute necessity. Mr. Ward quotes official reports against government ownership of cables and says: "The Atlantic Cable rate is the lowest in the world, except where a government pays the deficit by taxes."

NORWEGIAN HYDRO-ELECTRIC SCHEME.—Consul Felix S. S. Johnson, of Bergen, Norway, reports that a proposition is now being considered by the City Council of that place to utilize the water power of the streams in and about Bergen by a connecting system of tunnels and conduits.

NEW YORK EDISON SHOWING FOR 1908.—It may be interesting to note that on Jan. 1, 1909, the New York Edison Company had connected to its system a load of 6,805,991 16-cp equivalents. Itemized, this load is divided as follows: 3,480,719 incandescent lamps, 32,516 arc lamps, 1106 vapor arc lamps, 1103 kw in heating apparatus, 4430 kw in storage batteries and 205,373 hp in electric motors.

RADIUM BY THE TON.—In an article in the February *Harper's Magazine*, Professor Joly, of the University of Dublin, discussing the subject of radium and the internal heat of the earth, says that there are 20,000 tons of radium dissolved in the waters of the seas and "more than 1,000,000 tons of radium contained in the sediments which are deposited over the floor of the ocean."

SUPERVISION OVER PUBLIC SERVICE CORPORATIONS IN INDIANA.—A bill has been prepared for introduction in the State Legislature of Indiana providing for the enlargement of the powers of the Indiana Railroad Commission, so that it may have supervision over the rates charged by gas, water, telephone and city railway companies as well as other corporations serving the public.

GAS ENGINES SUPPLANTING DUTCH WINDMILLS.—Consul-General S. Listoe reports from Rotterdam that the windmill is no longer popular in Holland and is being supplanted by gas-engine pumping plants. As windmills are there principally used for the purpose of pumping water out of drain ditches, which must be done regularly in order to keep the fields and meadows dry, their uncertainty for this work is now recognized, and gas motors are gradually being introduced.

ILLUMINATING ENGINEERING SOCIETY.—The regular monthly meeting of the New York section of the Illuminating Engineering Society will be held Thursday, Jan. 14, at 8:15 p. m., in the United Engineering Societies' Building, 33 West Thirty-ninth Street, New York City. This is the annual meeting of the section and in addition to illustrated papers on the subject of "Street Lighting" by Mr. W. C. Allen, electrical engineer, District of Columbia, and Mr. S. G. Rhodes, engineer, meter and test department, New York Edison Company, an election will be held to fill the offices of chairman, secretary and two managers.

MORE CONTROL.—In his message to the Legislature, Governor Hughes, of New York, emphasizes the necessity of the closer control of water powers, and states that "it is deemed clear that 550,000 hp of energy is annually allowed to run to waste because no well-devised and comprehensive plan for the general and systematic development of water powers has been undertaken by the State." He also recommends that telegraph and telephone companies be placed under the supervision of the Public Service Commissions. Attention is also drawn to the present inadequacy of rapid transit and subway systems in Greater New York and the lack of public funds to supply the demand.

SOCIALISM IN CANADA.—A special dispatch from Winnipeg, Canada, of Jan. 9, says: "An amazing wave of public ownership is sweeping over the prairie provinces. It is announced that Alberta is selling $2,000,000 of bonds in London to construct a public telephone system. The premiers of three provinces are discussing a plan of public ownership of great grain elevators throughout the West. The Winnipeg Council has awarded contracts for more than $1,000,000 on a civic power plant, to cost $5,000,000 with all equipment. Edmonton is investigating a plan to develop a great power scheme for Alberta towns at Athabasca Falls, 150 miles away. New York, Montreal and London capitalists are purchasing the bonds."

OWNERSHIP IN JAPAN.—If we are to credit the sober statements of Prof. W. D. McClintock, of the University of Chicago, there were more suicides in Japan last year than in any 12 months in that nation's history. The professor attributes the increase to hard times, partly caused by government ownership, the pessimistic spirit of the people and the breaking down of the old religion. "The cost of living in Japan," said Professor McClintock in a talk before the George Howland Club, "is very high, and the people are complaining of the huge war debt. Japan, like many other countries, is face to face with the labor problem. The government owns the railroads, telegraph and telephone lines, and the business men declare that the experiment has not been successful."

ELECTRICITY FOR THE FARMER.—At State College, Pa., on Jan. 6, electricity as a means of lessening the drudgery of farm life was discussed by Prof. J. P. Jackson before the husbandmen attending Farmers' Week at the State School here. He showed how loneliness could be obviated by the use of telephones, how the new tungsten lamp made electric lighting of houses and barns possible at a rate little above the cost of kerosene. He pointed out the use of electric machinery for ploughing, cultivating, feed-chopping, threshing, wood-cutting and milking. Methods of lightening the housework, such as by electric churns, refrigerators, sewing machines, irons, ice cream freezers and meat choppers, were discussed to the gratification of the women. Utilizing water power was also explained. The speaker said that the streams of Pennsylvania could furnish all the electrical energy needed by farmers.

THOMSON-HOUSTON REUNION.—The proposed reunion of old Thomson-Houston employees, who were with the company before it became part of the General Electric Company, will take place in Chicago on Jan. 28, during the Electrical Show. There will be a banquet and "experience meeting" that night. The affair is in charge of the following committee: George Cutter, South Bend, Ind., chairman; H. L. Monroe, Monadnock Block, Chicago; P. H. Korst, Janesville, Wis.; Geo. P. Nichols, Old Colony Building, Chicago; I. E. Price, Canton, Ill. All veterans of the "T.-H." are invited to communicate with the members of this committee. It is hoped that Mr. C. A. Coffin, Prof. Elihu Thomson, Mr. E. W. Rice, Jr., and others who were among the creators of the great and progressive company with which their life work has been identified, will participate in this gathering. It is 25 years since the apparatus was shown at the first Electrical Exhibition in Philadelphia.

TELEPHONE TRAIN DISPATCHING.—The officials of the Santa Fé Railroad have announced that the entire Santa Fé system will soon be operated by telephone instead of telegraph. Telephone instruments and telephone apparatus necessary for installing a complete dispatching system has been purchased by the company for installation on 454 miles of the main line of the Santa Fé Railroad from Kansas City to Corwith, Ill. The company is now equipping its lines with telephones between Emporia, Kansas, and Kansas City, a distance of 205 miles, and is already operating the lines between Emporia and Newton, Kansas, a distance of 73 miles, by telephone. As soon as the telephone installations are completed at the Kansas City terminal the work of building the lines toward Chicago will be begun. It is expected the substituting of the telephone for the telegraph will involve an expense for the company of approximately $2,000,000. The officials of the Santa Fé Railroad are quoted as being very enthusiastic over the proposed change in the method of dispatching trains.

PANORAMIC VIEW OF ROCHESTER, N. Y., INDICATING LOCATIONS OF ELECTRIC GENERATING STATIONS.

System of the Rochester Railway & Lighting Company.

THE city of Rochester is situated in the County of Monroe, State of New York, about seven miles south of Lake Ontario and its central portion is nearly 263 ft. above mean lake level and 510 ft. above mean tide-water. The city is bisected by the Genesee River, which flows through it from south to north. Within the corporate limits the river has three falls and several rapids, having an aggregate descent of about 257 ft., affording power to many manufactories. The drainage area of the river at Rochester is 2365 sq. miles. The Erie Canal also passes through the city, besides the following named railroads: New York Central & Hudson River Railroad, West Shore Railroad, Erie Railroad, Lehigh Valley Railroad, Buffalo, Rochester & Pittsburg Railroad, and the Pennsylvania Railroad. The habitable area of the city is 17.68 sq. miles, and the estimated population, according to the State enumeration, is 204,000. Rochester has recently been put in the first class.

Electrical energy for all purposes is supplied by the Rochester Railway & Light Company, which company also furnishes energy for the street railway system and operates the gas works. Within the city limits the railway company operates 36 miles of double-track road and 13 miles of single-track road, besides a double-track railroad from Rochester to Charlotte, on Lake Ontario, on the west side of the Genesee River, and another double-track road on the east side of the river to the lake. In addition, an electric railway is operated to Sea Breeze, at the junction of Irondequoit Bay and Lake Ontario, and another line from Rochester to Glen Haven, near the head of the bay. This line extends to Sodus Point, a distance of about 40 miles. The company also operates the Rochester & Eastern Rapid Railway running between Rochester and the thriving city of Canandaigua, a distance of approximately 27 miles.

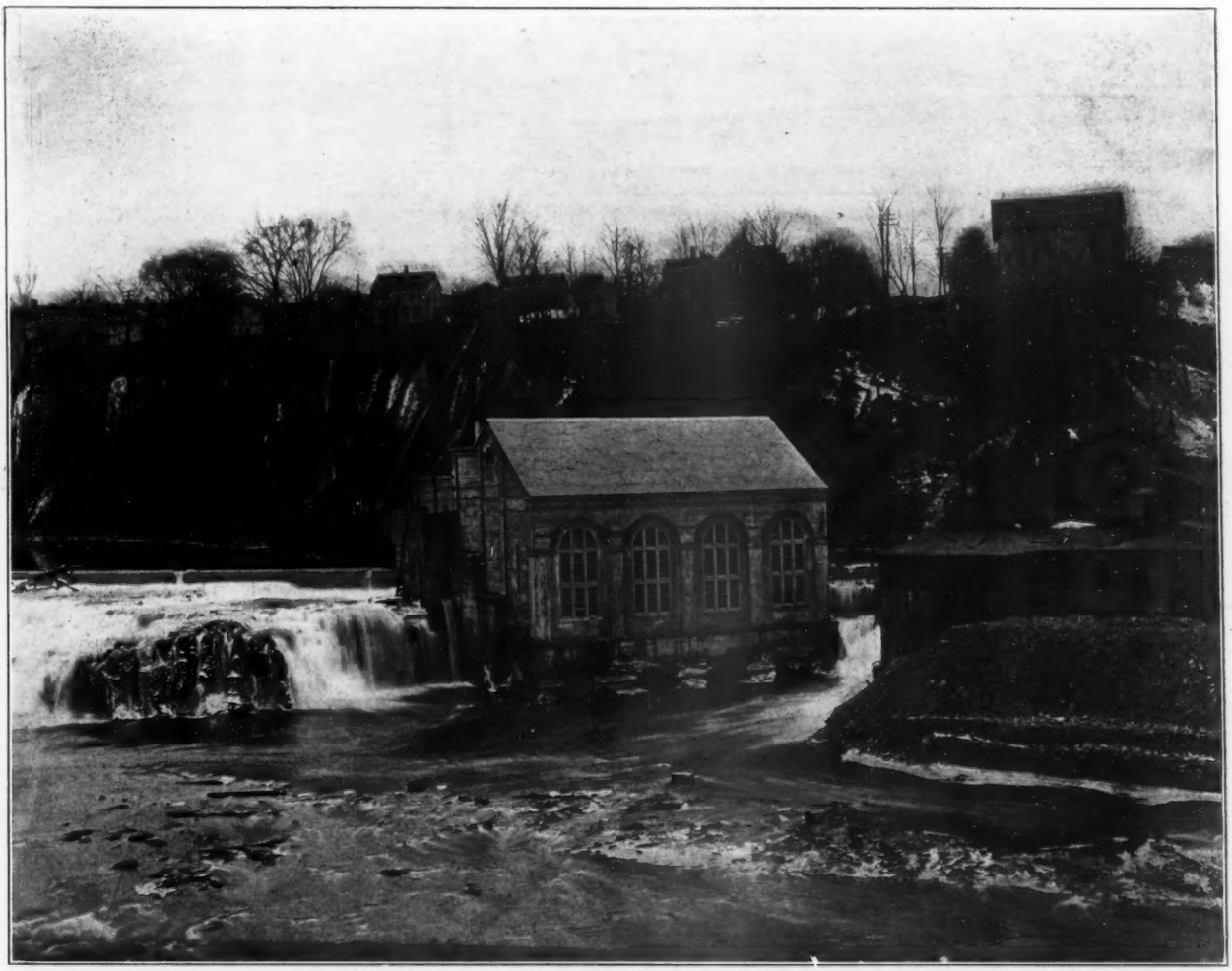


FIG. 1.—STATION NO. 15 OF THE ROCHESTER RAILWAY & LIGHT COMPANY ON MIDDLE FALLS.

The Rochester Railway & Light Company was incorporated in New York May 26, 1904, and is a consolidation of the Rochester Gas & Electric Company and the Rochester Light & Power Company. Included in the present company are the following old gas and electric companies: Rochester Gas Company, Citizens' Gas Company, Municipal Gas Company, Rochester Electric Light Company, Brush Electric Light Com-

pany, Edison Electric Light Company and the Citizens' Light & Power Company. The history of electric lighting in Rochester since the formation of the first company is interesting. In 1880 the Rochester Electric Light Company was organized, Mr. L. P. Ross being its president, and Mr. G. A. Redman, who up to a few years ago was still actively connected with the lighting company in Rochester, as director. This company started business in a room in the Bee Hive Building and shortly afterward moved to the Whitney property on the Upper Falls, where it remained until it was consolidated with the Rochester Gas & Electric Company. The Brush Electric Light Company was organized in 1881, starting business with two machines, at the corner of Water and River Streets and afterward moved to the Lower Falls on the west side of the river, having purchased a portion of the water-power rights. A few years later the company acquired all the water-power rights of the Lower Falls and built a large stone building on the east side of the river. It was merged with the Rochester Gas & Electric Company in 1900. The Edison Electric Light Company was formed in 1886, and began business with a steam-driven plant on Edison Street, soon after purchasing several important water-power rights on the Brown's Race and erecting a stone building at that point. This company was merged with the Rochester Electric Light Company in 1891. The first arc lamps placed in service brought $1 per lamp per night, the charge gradually diminishing to 75 cents, then to 50 cents and finally to 25 cents per night. The rate for electrical energy was at first 20 cents per kw-hour, and latterly 14 cents per kw-hour, but about four-fifths of the business was conducted on flat rates. Its equipment at that time consisted of Brush, Thomson-Houston and Western Electric arc machines and Edison bi-polar machines. At the time of the first consolidation, in 1891, Mr. J. Lee Judson was president of the company.

The Citizens' Light & Power Company commenced operations in 1892 and built a plant on Brown's Race in 1893. Brown's Race is an artificial waterway 30 ft. wide by 7 ft. deep, running from the Genesee River at Central Avenue to Brown Street, where the overflow returns to the river. The Citizens' Light & Power Company built its plant on the river bank below the race, where a head of 93 ft. was available. The original plans called for a building eight stories high, but this was finally modified and a building three stories high and a wheel pit were erected. The company started with one or two machines, but at the time of the destruction of the plant by fire, on Nov. 25, 1900, there were installed three 500-hp waterwheels, two 600-hp Corliss engines and one 600-hp Woodbury tandem-compound engine, all of which were connected with four jack-shafts to the floor above by rope-drives. In the boiler room there were eight 125-hp horizontal tubular boilers, and on the floor above the shaftroom there were six 150-kw double-current Westinghouse dynamos, belt-driven from clutch pulleys on the jack-shaft below. The generators gave 380-volt, two-phase, 50-cycle current from one end, and 500-volt direct current from the other end, the idea being to operate all of the alternating-current ends in multiple from the alternating-current switchboard, and to control all the direct-current ends from the direct-current switchboard. The final arrangement consisted in running the alternating-current ends together and installing two 150-kw multipolar machines for the 500-volt direct-current work, as there was usually a pyrotechnical wind-up when an attempt was made to operate both ends of the double-current machines at once. There were also at that time two Western Electric 60-light series arc machines in operation. After the plant was destroyed, it was bought by the Brady interests, who built a modern station, designed by Mr. T. E. Murray, of New York. The Citizens' Light & Power Company was acquired by the Rochester Gas & Electric Company in 1902.

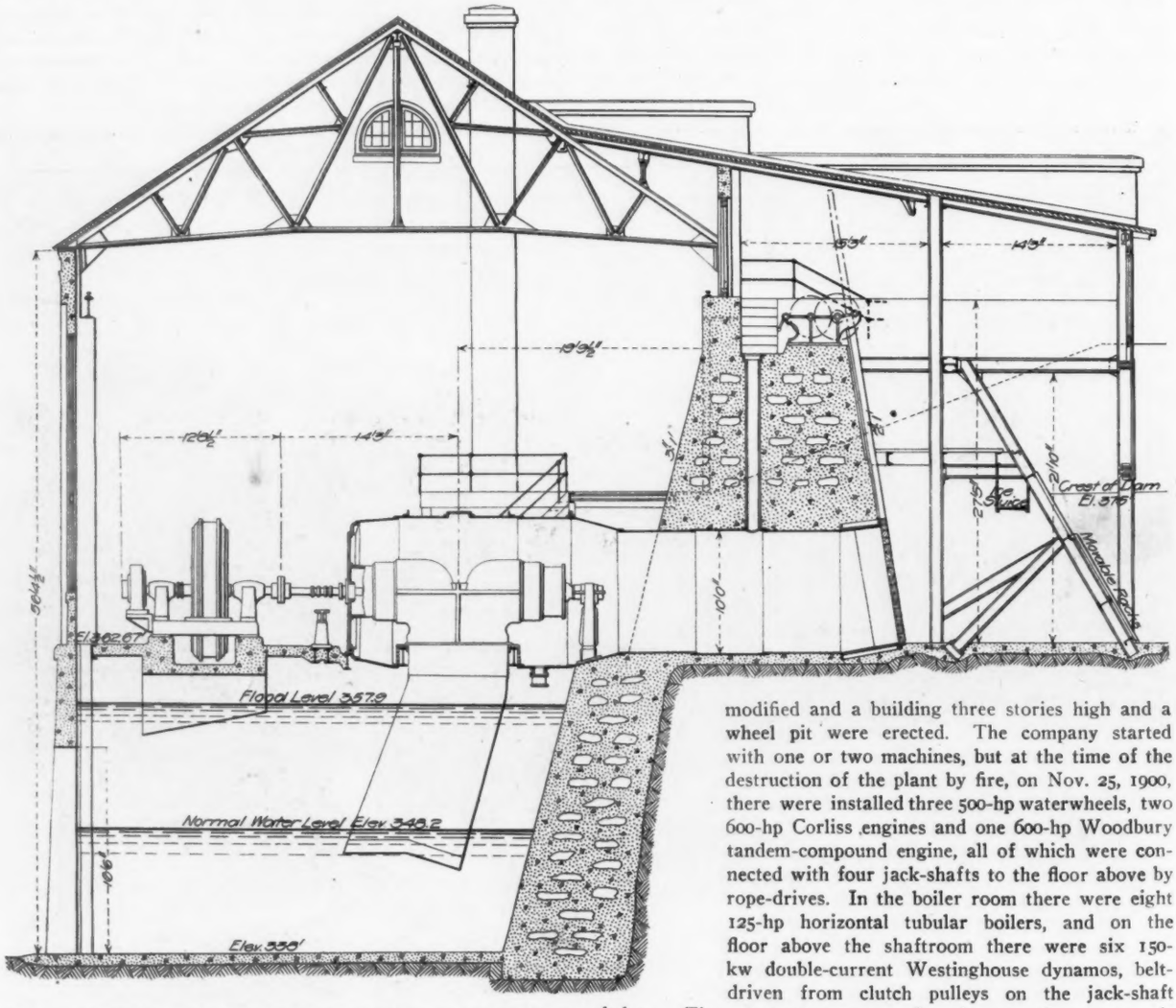


FIG. 2.—SECTIONAL ELEVATION OF STATION NO. 15 OF THE ROCHESTER RAILWAY & LIGHT COMPANY.

The generating stations at present operated by the Rochester Railway & Light Company and their locations are as follows:

Name.	Location.	Character.
Station No. 1	—Mill and Commerce Sts.	Steam power
Station No. 2	—Brown's Race and Furnace St.	Steam and water power
Station No. 3	—Mill St., opposite Factory St.	Steam and water power
Station No. 4	—Central Ave. and No. Water St.	Water power
Station No. 5	—Driving Park Ave. & St. Paul St.	Water power
Station No. 6	—So. Water St. and Aqueduct	Water power
Station No. 15	—Middle Falls	Water power
Station No. 26	—Graves St.	Water power

Stations 7, 8, 9, 10 and 11 are used entirely for street railway purposes and are situated in Charlotte, Penfield, Ontario, Sodus and Webster.

From the above, it is evident that the chief source of power is the Genesee River, although steam-driven generators are used and electrical energy is also transmitted from the Niagara Falls plant of the Ontario Power Company. During certain portions of the year the water power furnished by the Genesee River is all that can be desired, but during dry weather the river is so low that it is necessary to use steam to carry the load. For this reason a brief description of the river may be of interest.

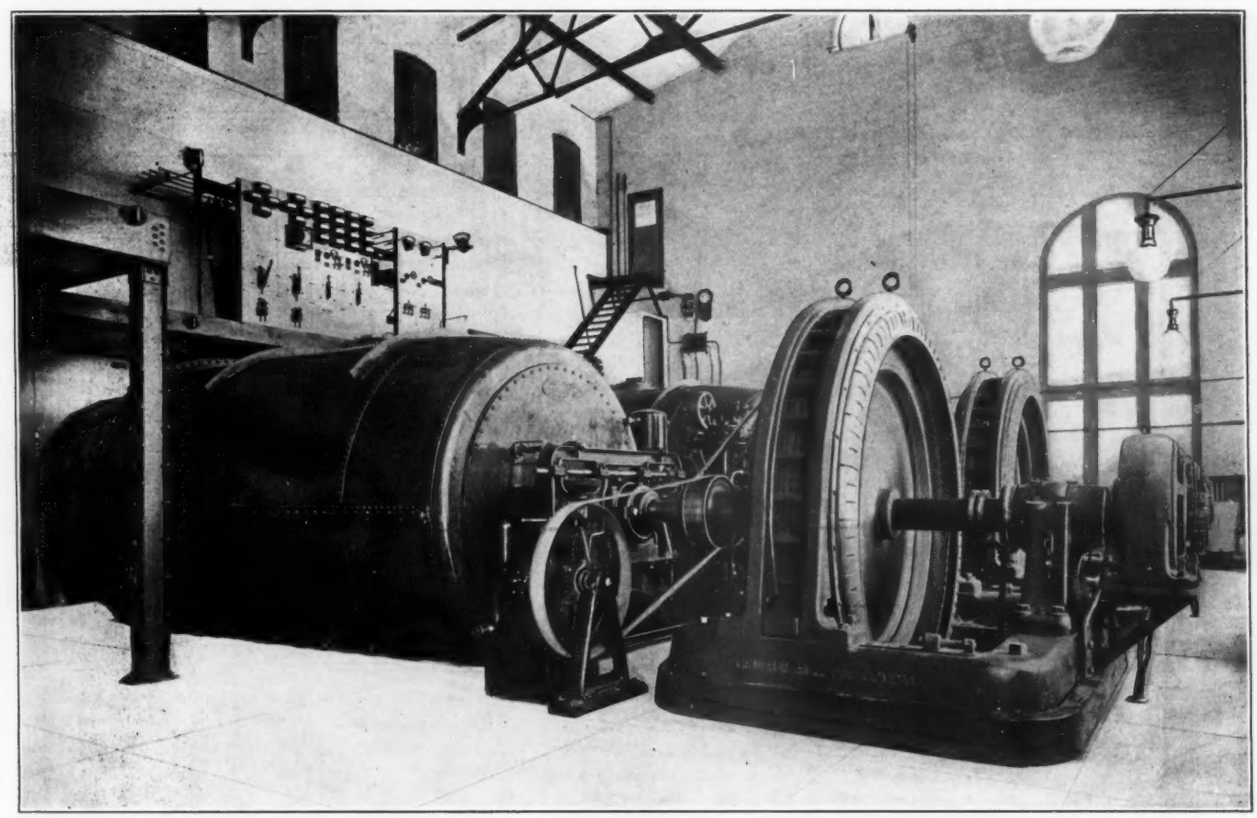


FIG. 3.—INTERIOR OF STATION NO. 15 OF THE ROCHESTER RAILWAY & LIGHT COMPANY.

The Genesee River rises in Potter County, Pennsylvania, 15 miles south of the New York State line. At Genesee Forks, Cryder Creek, East Branch, Middle Branch and West Branch unite. The total catchment area of these streams below the mouth of the creek is 143 sq. miles. The streams have a fall of about 47 ft. per mile. The valleys are narrow and there is little opportunity for storage upon them. From the State line to Wellsville, a distance of about 10 miles, the average fall is 31 ft. per mile. A short distance above Wellsville broad flats begin, which continue with little interruption to Portage. At Portage the river falls 330 ft. in three miles. From the foot of Portage Falls to Mount Morris the average fall is at the rate of 10.6 ft. per mile. From Mount Morris to Rochester, above the feeder dam, the distance is about 46 miles, and the average fall per mile is 1.2 ft. The flats along this portion of the river are the great storage ground. From above the feeder dam at Rochester to above the Upper Falls the distance is two miles and the average fall in the river is 13.5 ft. per mile. From above the Upper Falls to the foot of the Lower Falls there is a total drop of about 231 ft., an average of 115.5 ft. per mile. From the Lower Falls to Lake Ontario there is only a difference of about 2 ft. In the foregoing description no account has been taken of the several dams across the river, the description applying to the river in its natural state. The distance measured along the meander is taken at approximately 145 miles, and the catchment area is 108 miles measured in a straight line. The average width of the catchment is about 22 miles.

The clearing of the forests and draining of lands, together with improvements in the drainage of towns along the Genesee Valley, have resulted in a rapid run-off, so that the flow of water at Rochester varies from a maximum of 54,000 cu. ft. per second to a minimum of 150 cu. ft. per second. It would thus seem that with so erratic a stream the problem of continuous electric supply would be a rather difficult one. However, the engineers of the Rochester Railway & Light Company have taken advantage of every opportunity for utilizing the flow of the river, and the arrangement of the stations along the river and the electrical interconnections between them have resulted in an extremely flexible and interesting system.

The company has in all eight generating stations, some of which are also substations, and eight substations. Two of the latter are strictly railway stations with rotary-converter equipment, and three are for commercial lighting service and are equipped with motor-generator sets.

STATION NO. 15.

Station No. 15, situated on the west bank of the river at the Middle Falls, is the latest generating plant erected by the company, having been placed in operation in the spring of 1907. The location of the plant is well shown in Figs. 1 and Figs. 2 and 4 show cross-sectional and plan views from which the layout is readily apparent. The equipment in this station consists of two 900-hp turbines built by the S. Morgan Smith Company, of York, Pa., direct-connected to two 500-kw, 4150-volt, three-phase, 60-cycle General Electric alternators. The switchboard is made up of two generator panels, two feeder panels and two

exciter panels. The entire station layout is the acme of simplicity. The generators are equipped with exciters fastened to a bracket beyond the outboard bearing and driven from the main shaft. Between the generator and its water-wheel is a Sturgess water-wheel governor with switchboard control. As is probably known, poppet valves are used in this controller for regulating the passage of high-pressure oil to the main cylinder. A centrifugal governor belted from the water-wheel shaft operates a pilot valve controlling the operating cylinder. The latter in turn controls the main cylinder which operates on the main gate shaft. In order to prevent racing, a compensator is used to give stability to the governor.

The structure is built of reinforced concrete and the intake gates are inclined at an angle to the flow of the stream, so that the tendency is to keep the racks clear of floating ice, refuse, etc. The location of the station is particularly well chosen in that there is a pondage or storage capacity of about 8,000,000 sq. ft., and by means of flash boards 2 ft. high and by partially shutting down the gates for 20 hours, a storage capacity of 16,000,000 cu. ft. of water, equivalent to an output of 1500 kw for 2½ hours, can be secured. The advantage of this at peak load is apparent. By holding back the water for the time indicated, or until it is required, a peak load of 3750 kw-hours can be carried without any additional investment. The available head of water at this station is 27 ft.

The efficacy of this simple expedient of using flash boards to impound water at a point where no other means of storage exists was well shown during the recent drought. On Jan. 5 water went over the dam at Rochester for the first time since July. During the interim water conditions were very acute. At times there was barely enough water for the condensers of the engines at Station No. 3. During the emergency the latter station, as well as the other steam stations, were run overloaded. Station No. 15 and Station No. 5 were shut down during the day when water was scarcest and the water impounded at Station No. 15 until the peak load at night, when the water was allowed to pass through the turbines at Station No. 15 and then through the turbines in Station No. 5 farther down the river. In this way the company was able to carry peak loads without serious difficulty in the face of the fact that the water in the Genesee River had not been so low in a period of over 20 years.

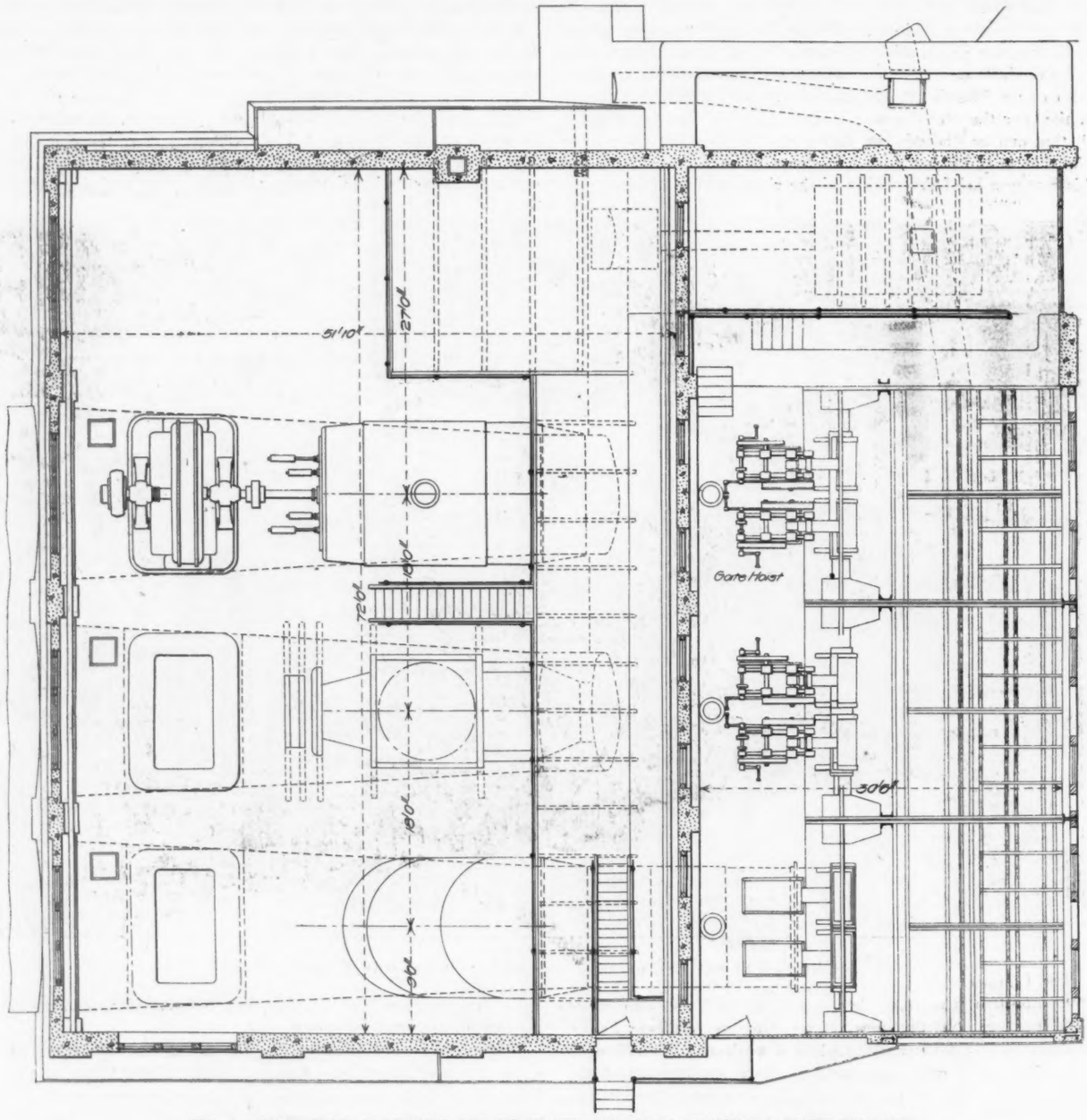
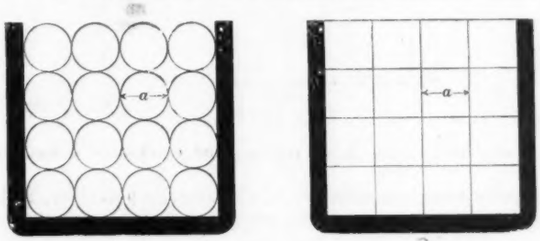


FIG. 4.—PLAN VIEW OF STATION NO. 15 OF THE ROCHESTER RAILWAY & LIGHT COMPANY.

Factors Governing the Space Utilization of Electromagnetic Windings.

BY CHARLES R. UNDERHILL.

THE coefficient of space utilization of an electromagnetic winding is, usually, defined as being the ratio of volume of copper to volume of winding space. Hence, under ideal conditions the space utilization would be 1, or 100 per cent. Such an ideal winding might be a hollow cylinder of solid copper or it might consist of an infinite number of turns of bare square wire whose cross-section should be vanishingly small. The reason why the ideal condition could not exist, otherwise, in a winding space such as on a bobbin with flat-faced heads or



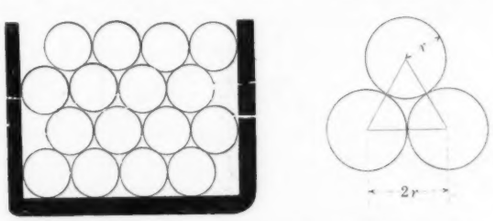
FIGS. 1 AND 2.—SPACE UTILIZATION OF ROUND AND SQUARE WIRES.

washers (neglecting the insulation on the wire) is due to the turning back of the turns of subsequent layers over those of preceding layers, which causes a loss of one turn per layer.

In practice the wire is not only insulated, but is usually of circular cross-section. Hence, a comparison of the round-wire and square-wire windings in Figs. 1 and 2 will show that the space utilization of the winding in Fig. 1 will be only $\frac{\pi}{4} = 0.7854$ of that in Fig. 2, the dimension a being the same in both cases.

In the round-wire winding the layers have a tendency to imbed, i. e., the turns of subsequent layers sink between the turns of preceding layers at certain points. At the point where the turns of adjacent layers cross one another they appear as in Fig. 1. Diametrically opposite this point there is a similar crossing point, but at the ends of a diameter at right angles with this one, the turns of the upper layer sink into the grooves between the turns beneath it, as in Fig. 3. The transition from one of these conditions to the other is, of course, gradual.

From Fig. 4 it will be seen that the space consumed by the wire when imbedded is proportional to $2r^2\sqrt{3} = 3.46\,r^2$, where r is the radius of the wire. In the other case, however, where the wires on subsequent layers lie exactly on top of those of the preceding layers, as in Fig. 1, the space consumed is proportional to $4r^2$. It is, therefore, fair to assume that the actual



FIGS. 3 AND 4.—SPACE UTILIZATION BY IMBEDDED WIRES.

space consumed in a wound magnet is proportional to the average between the two conditions, or $\frac{3.46\,r^2 + 4\,r_2}{2} = 3.73\,r^2$.

Since the number of turns N is proportional to the reciprocal of the square of the radius of the wire, N is proportional to $\frac{1}{3.73\,r^2} = \frac{0.268}{r^2}$, or in terms of d_1^2, (d = diameter of bare wire, d_1 = diameter over insulation) N is proportional to

$$4\left(\frac{0.268}{r^2}\right) = \frac{1.072}{d_1^2}$$

Hence, there is, theoretically, a gain of 7.2 per cent due to imbedding, which, under the conditions thus far considered, makes the space utilization $\Psi = 0.7854 + 0.072 = 0.8574$, or $\Psi = 85.74$ per cent.

The loss due to turning back, previously mentioned, is proportional to $\frac{1}{mL}$, wherein m represents the turns per unit length, and L the interflange length of the winding space. In the above it is assumed that the turns are at right angles with the axis of the winding. Fig. 5 shows that while this loss is not great for small wires, it may be considerable for large wires where L has a small value. Under these conditions $\Psi = 0.8574 - \frac{1}{mL}$ Thus, a winding consisting of No. 10 B. & S. bare wire wound between two faces 2.54 cm apart would have a loss of approxi-

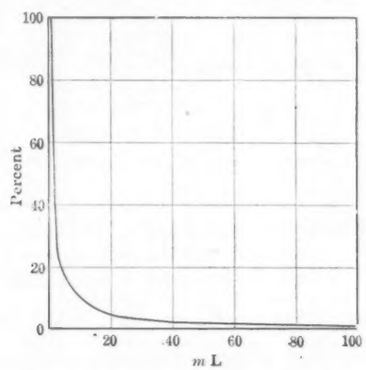


FIG. 5.—LOSS OF SPACE BY CHANGE OF PLANE OF WINDING.

mately 10 per cent due to the turning back of the turns. In this case $\Psi = 0.8574 - 0.10 = 0.7574$. This, however, is an extreme case.

There is another effect due to the turning back of the turns at the ends of the layers which results in an additional loss throughout the entire winding. This effect was discussed in a previous article,* but will be briefly mentioned here. Since an electromagnetic winding consists of spirals, the inclination of which are alternately right and left, there will be an inclination of the turns toward the axis of the winding. This inclination will be greater for small and less for large diameters of turns; hence, the diameter of the average turn should always be taken for the average inclination.

If l = the distance between adjacent turns, center to center, and M = the average diameter of all the turns, then the loss due to this effect will be as represented in Fig. 6. This illustration shows very clearly that the so-called "haphazard"

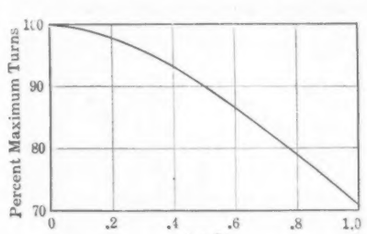


FIG. 6.—LOSS OF SPACE BY SPIRALING.

and similar windings have a lower value for Ψ than have those wound in layers. In this case with a No. 16 B. & S. cotton-covered wire winding, evenly wound in layers, and in which the average diameter, $M = 1$, the loss due to the inclination would be approximately 1.7 per cent.

Thus far the relation of the space occupied by the conductor to that of the insulation covering it has not been considered. The space utilization ratio or practical utilization for round wire is $\frac{d^2}{d_1^2}$. Fig. 7 shows the utilization and the utilization

*Electrical World, Dec. 21, 1907.

ratios for insulated round wires. In this the other factors, such as imbedding, etc., are not considered.

The space utilization of an electromagnetic winding is equivalent to the conductivity ratio of the conductor itself, where the

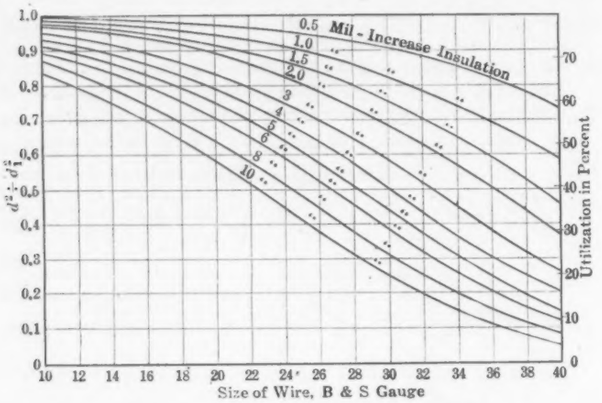


FIG. 7.—LOSS OF SPACE BY INSULATION ON WIRES.

dimensions of the winding space are limited. This may be appreciated by reference to Figs. 8 and 9. In Fig. 8 the turns and length of wire are constant, and the resistance and size of wire are variable. In this case, if a given winding space be occupied by, say, 5000 turns with a coefficient of $\frac{d^2}{d_1^2} = 0.25$, and an exactly similar winding space contains 5000 turns, but with the coefficient of $\frac{d^2}{d_1^2} = 0.5$, the latter winding will contain the same number of turns and length of wire as the former, but will have only one-half of the resistance with the cross-section of the wire doubled. Here the size of wire varies directly, and, consequently, the resistance varies inversely as $\frac{d^2}{d_1^2}$. Hence with constant e.m.f., the m.m.f. and watts will vary directly as $\frac{d^2}{d_1^2}$

In Fig. 9 the resistance is constant and the turns, cross-section and length of wire are variable. In this case the number of turns and length of wire vary directly as $\sqrt{\frac{d^2}{d_1^2}}$, and the cross-section of the wire varies directly as $\left(\frac{d^2}{d_1^2}\right)^2$. With constant e.m.f. the m.m.f. will vary directly as $\sqrt{\frac{d^2}{d_1^2}}$, and the watts will remain constant.

In Fig. 10 the cross-section of wire is constant and the resistance turns and length of wire are variable. It is, of course,

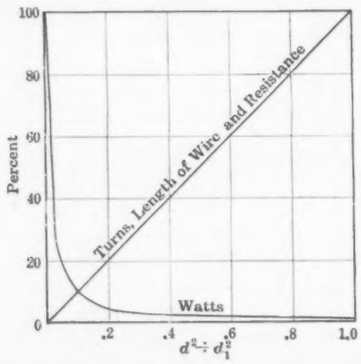


FIG. 8.—CHARACTERISTICS OF WINDING OF CONSTANT NUMBER OF TURNS AND LENGTH.

obvious that the three variables vary directly as $\frac{d^2}{d_1^2}$. With constant e.m.f. the m.m.f. will be constant, and the watts will vary inversely as $\frac{d^2}{d_1^2}$.

The effect of an increased space utilization is more marked in a winding of small than one of large diameter, and it varies directly with the length L of the winding. Fig. 11 shows the various relations, p_{min} and p_{max} being the minimum and maximum perimeters, respectively; p_a the average perimeter, and T the thickness, or depth, of the winding.

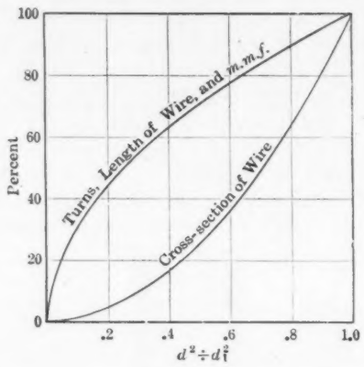


FIG. 9.—CHARACTERISTICS OF WINDING OF CONSTANT RESISTANCE.

As a test of the imbedding theory, the writer constructed a solid-steel bobbin exactly 2.54 cm in length between heads, having a core 1.27 cm in diameter. This was wound by hand by an experienced operator with various sizes of single-silk-covered magnet wire ranging from Nos. 21 to 34 B. & S. gage. The

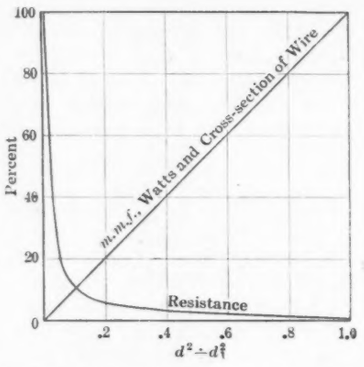


FIG. 10.—CHARACTERISTICS OF WINDING OF CONSTANT CROSS-SECTION.

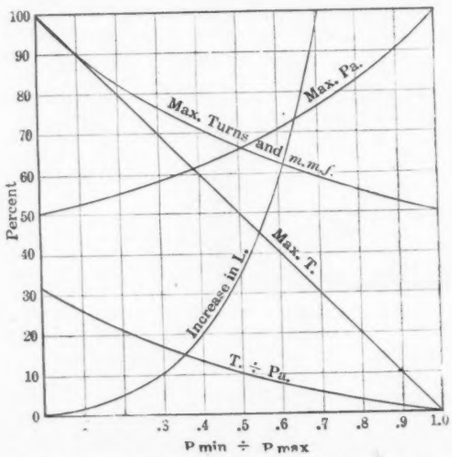


FIG. 11.—EFFECT UPON CHARACTERISTICS OF WINDINGS OF VARYING THE PERIMETERS.

values for d_1 were observed by means of a ratchet-stop micrometer. Fig. 12 shows the relation (for eight layers) between thickness of winding T and the calipered diameter of the insulated wire. Even with 7.2 per cent allowed for imbedding, there

was found to be an additional "flattening out" of the insulated wire, due to the vertical compression of the wire, owing to the tension. This averaged approximately 6 per cent.

For a constant thickness of insulation it would appear that the flattening effect would vary with different sizes of wire, but since the tension on the wire, during the winding process, decreases as the diameter of the wire decreases, it remains practically constant for the sizes of wire mentioned above. An examination of the wire when removed from the experimental

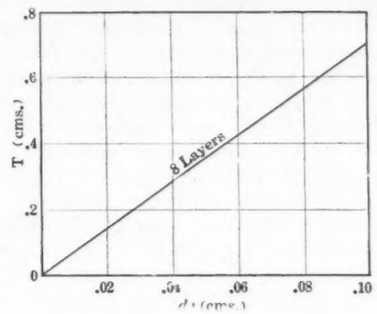


FIG. 12.—TEST OF AN 8-LAYER MAGNET WINDING.

bobbin showed that the wire had not been appreciably stretched in winding. The apparent gain of approximately 6 per cent was found to be compensated by a loss of approximately 6 per cent in the turns per unit length.

The formula used for calculating the actual average thickness of the winding per layer is

$$t = \frac{T}{0.933\ (n-1) + 1} \qquad (1)$$

wherein n = the number of layers,

and T = thickness, or depth, of winding.

It will be observed that in this formula an allowance of 7.2 per cent has been made for imbedding.

By transposition,

$$n = 1.072\left(\frac{T}{t} - 1\right) + 1 \qquad (2)$$

and

$$T = t\ [0.933\ (n-1) + 1] \qquad (3)$$

The loss due to inserting paper into the winding at intervals may be determined by removing the paper from the winding, wrapping it around the core and calculating the new volume of the winding space. The losses in winding due to carelessness, splicing and in insulating joints, etc., are factors which may be determined only by experience. The tension on the wire should be constant and so adjusted that at a maximum it will not stretch the wire.

A Classification of Electrical Engineering Data.

BY GEORGE W. LAMKE.

In order that all notes, catalogs, etc., on any electrical subject could be located in the shortest possible time, the study of a classification of electrical engineering data was undertaken to meet this requirement. There was only one classification available, in print, at the time this study was taken up. This was published in the *Electrical World and Engineer*, Vol. 46, page 910, by Mr. George Parsons. In the February, 1906, number of *The Electric Journal*, Mr. Parsons published a revised system of classification which he found necessary owing to the rapid growth of the electrical industry and to the amount of data accumulating. A later classification, and one going into minutest details, was given in Bulletin No. 9 of the University of Illinois Engineering Experiment Station. Each of these classifications has merit, but one required a large number of cross references and the other went into details which are not at all necessary for the average engineer. The classification given below requires very few, if any, cross-references, and goes into sufficient detail for a general classification. The arrangement is a logical one and is new and unique in at least one particular.

A "General" topic is given first, under which head are placed all books, catalogs, pamphlets, etc., which treat of a variety of electrical subjects and which for that reason cannot be placed under any particular subhead. Under "General Theory" all books, pamphlets, etc., treating of the theory of a variety of electrical subjects are placed. Following this comes the subhead "Energy Conversion." Under this head is placed subject matter dealing with all types of machines which convert energy from one type to another. This arrangement makes it possible to place the subject "Electric Motors" with the subject "Electric Generators," at the same time giving it an equally important place, which the subject really deserves. After "Energy Conversion" the next logical step is the "Control" of the converted energy. As this classification is of electrical data mainly, electricity "Control" only is classified. There may be some

1	GENERAL.
11	Materials.
111	Magnetic.
112	Conducting.
113	Insulating.
12	Statistics.
13	Theory—General.
14	Measurements.
15	Testing.
16	Educational.
2	ENERGY CONVERSION.
21	Thermodynamic.
211	Boilers and Auxiliaries.
212	Steam Engines.
213	Steam Turbines.
214	Gas and Oil Engines.
22	Hydrodynamic.
221	Water Supply.
222	Dams.
223	Flumes.
224	Water Wheels and Turbines.
23	Electrodynamic.
231	General.
2311	Armatures.
2312	Fields.
2313	Frames.
2314	Commutators.
2315	Brushes.
232	Generators.
2321	Alternating Current.
2322	Direct Current.
233	Motors.
2331	Alternating Current.
2332	Direct Current.
3	CONTROL.
31	Switchboards and Acessories.
32	Meters.
321	Indicating.
322	Integrating and Recording.
323	Miscellaneous.
33	Protective Devices.
331	Circuit Breakers.
332	Fuses.
333	Lightning Arresters.
334	Relays.
34	Switches.
35	Voltage Regulators.
36	Boosters.
37	Rheostats and Resistances.
38	Miscellaneous Apparatus.
4	TRANSFORMATION—ELECTRICAL.
41	Frequency Changers.
42	Motor Generators.
43	Rectifiers.
431	Commutating.
432	Electrolytic.
433	Vacuum Tube.
44	Rotary Converters.
45	Transformers.
451	Constant Potential.
452	Constant Current.
453	Series.
454	Induction Coils.
5	TRANSMISSION.
51	Alternating Current Systems.
52	Direct Current Systems.
53	Lines and Accessories.
6	DISTRIBUTION.
61	Alternating Current Systems.
62	Direct Current Systems.
63	Lines.
631	Overhead.
632	Underground.
633	Interior Wiring.
7	UTILIZATION.
71	Electric Lighting.
711	Arc Lamps and Lighting.
712	Incandescent Lamps and Lighting.
713	Photometry.
72	Electric Railways.
721	Systems.
722	Operation.
723	Route.
724	Rolling Stock.
73	Electric Heating.
74	Electric Signaling.
75	Electro-Chemistry.
751	Storage Batteries.
752	Primary Batteries.
76	Electro-Magnets.
77	Telegraphy.
771	Land.
772	Marine.
773	Wireless.
78	Telephony.
781	Lines.
782	Switchboards.
7821	Manual.
7822	Automatic.
783	Substation Apparatus.
7831	Manual.
7832	Automatic.
784	Wireless.

doubt as to whether "Electrical Transformation" or "Electrical Transmission" should come next, but, after a careful consideration, it seemed proper that the former should have the place since often many types of electrical transformers are used before the power is transmitted and distributed. "Transmission" and "Distribution" follow naturally, with "Utilization" last.

Each subject has been given a number according to the decimal system. Thus, at any time, this classification can be made a part of the "Dewey decimal system" by simply prefixing the number 621.3, which is the number assigned to electrical engineering in the Dewey system. These numbers also form a convenient numerical classification.

The method of applying this classification is as follows: An index guide card of the usual type, 3 in. x 5 in., one-half cut, is made out with the name of the subject on the tab. The corresponding number of the subject appears in the upper left-hand corner of the same card. These cards are placed in an ordinary card-file case in the order given by the classification and are used as guide cards for a reference file. A separate card is made

for each reference, which bears the title of the reference, the name of the author and the volume and page of the periodical or book in which the given article appeared. Then follows a brief description of the article. Separate files are kept for notes and catalogs, and the tabs of the guide cards for these files bear only the number of the subject and are kept in numerical order. For more voluminous notes and pamphlets, and for catalogs, standard letter-size vertical files are used, while for less voluminous notes an ordinary card file, size 5 in. x 8 in., is found convenient.

Although four files are necessary for filing all data, excluding books, all data upon a given subject may be located very quickly. For example: If the subject of "Electrolytic Rectifiers" is under investigation, to find all available data the guide card in the reference file must first be found. The mental process in finding this card would be: Electrical Transformation; Rectifiers; Electrolytic. Back of this card would be found all references on the subject. The subject number is found from the guide card, and all data in the other files can be located in less than a minute by looking back of the guide cards bearing this number in each of the other files.

The writer does not claim completeness for this classification, but it will meet the general needs of the average electrical engineer. The classification lends itself to a much more detailed subdivision for those who are specializing in any one of the many electrical branches, and the special subject is then a part of the whole. Even the specialist has a large amount of general data which it is convenient to have classified, and the classification meets this general need as it stands.

Other subjects outside the scope of electrical engineering may be classified similarly and the general number assigned to such subjects in the Dewey system may be prefixed and one may then have all his data, books, pamphlets, etc., come under a general library classification. In the latter case a number of subjects given in the below classification could be more properly placed somewhere else than under electrical engineering:

The Theory of Lightning.—II.

By Daniel S. Carpenter.

In the first part of this article, published last week, the electric charges of clouds were considered. In this concluding part the surface of the earth, considered as a conductor upon which charges are induced by the cloud charges, will be studied. Some portions of the earth's surface are covered by rock formation in which no mineral matter occurs, by dry sand or other non-conducting material, all of which are very imperfect conductors and must be considered a part of the dielectric intervening between the cloud and the conducting portion of the earth below. Permanently moist earth is a fair conductor, and, where it occurs, it is found at a depth below the surface of the earth varying with the local conditions as to rainfall. Very often the severest thunderstorms are preceded by periods during which there is no rainfall, and the surface of the earth must be considered practically as a non-conductor for lightning discharges. Below the surface of the earth there are strata of porous soil which are always saturated with water and which very often extend over large areas and are, since the water contains salts, very good conductors. Water systems consisting of an extensive system of iron pipes, if they derive their water supply from these underlying strata, add to the area, the whole forming a large conducting sheet, overlaid by a sheet of earth of varying resistance which, in general, would have a much higher resistance than the underlying sheet just mentioned. It is thus seen that the surface of the earth may consist of:

(1) Non-conducting formations, as rocks, which may be of great extent and extend to a great depth, as, for example, the chalk cliffs of England.

(2) Non-conducting material at the surface with an underlying sheet which is conducting.

(3) Conducting sheet of water or other material at the surface.

(4) Non-conducting material at the surface with a conducting sheet underneath which outcrops or projects above the non-conducting surface sheet at points.

(5) Conducting material on the surface with an underlying stratum of lower resistance.

Thus, it may be said that a greater or less distance below the earth's surface there is a vast conducting sheet upon which the cloud charges induce charges. The charge on this sheet, similarly to the charge on the raindrop, is a function of a large number of cloud charges. The surface of this sheet is not regular, but will have points where more or less perfectly conducting objects project far above it and thus form a path along which a lower cloud potential will be able to establish a discharge than along any other path available. A stratum of soil, saturated with water, and forming a part of the conducting sheet at a place where the portion of the earth above the sheet is non-conducting, may outcrop at some point. A tree whose roots are either imbedded in moist earth or lie in close proximity to a system of water pipes may form such a path. The large iron pipes of a water system form a conductor of large external surface in contact with permanently moist earth at many points and can be said to consist of a large number of conductors of large external surface arranged in parallel and terminating in the conducting sheet of the earth. This is also true of trees. In order that they may replace the large amount of moisture lost by evaporation, their roots must penetrate to permanently moist earth and must terminate in a multitude of rootlets and root hairs. The root hairs of some trees give off a weak acid, which, reacting upon the soil, forms a salt soluble in water, thus reducing the soil to a condition in which it can be assimilated, and incidentally forming a sheet of very high conductivity in contact with the rootlets. We have here again a discharge path formed of innumerable conductors in parallel, which terminate in permanently moist earth. The woody fiber of the tree is not a good conductor, but the sap is, and so the tree forms an imperfect conductor with a good earth.

Metal rods, wires, ropes, etc., may form nearly an unbroken path from the top of a tower or church steeple to ground, thus rendering these objects liable to be struck by lightning.

After rain has been falling for some time the condition of the surface of the earth in regard to conductivity is modified somewhat, although surface water has a high resistance, one author stating that it is 25,000 ohms per cubic centimeter.

Some of the notable instances on record in which the conducting sheet of the earth did not coincide with its surface where the bolt struck are as follows: During a thunderstorm in the Tyrol lightning struck a pile of wood which lay on a rock, setting fire to the wood and splitting the rock. After the flames were extinguished, it was noticed that a stream flowed from the rubbish. Further examination showed that the water proceeded from the lightning-created cleft in the rock, and chemical analysis demonstrated that the water was impregnated with magnesium and iron in the form of sulphates. This was an instance where the conducting sheet came near the surface.

In the Maritime Alps a lightning discharge made a broad and deep fissure in the mountain-side for a distance of 20 m, detaching a solid mass measuring several hundred cubic meters before it reached a place where there was a good earth. Again, lightning strikes an electric circuit, leaps to ground and, not finding a good earth after scoring the ground up for some distance, passes to a telephone circuit and thence to earth by a bell wire quite a distance from the point where it entered the telephone circuit.

To earth means to the conducting sheet of the earth. The greatest care should be taken to make a good earth. Conductors of such form as to have a large external surface rather than a large cross-sectional area should be selected. Due to the enormous value of $\frac{di}{dt}$ in the expression $L\frac{di}{dt}$, it is very difficult to provide a conductor with negligible impedance. The current penetrates very slightly into the conductor, so the ex-

ternal surface must have a large area in order that the active portion of the conductor may be of sufficient magnitude to permit a free discharge to take place, which can only occur when the current density is not too great.

As the clouds are relatively very far above the earth's surface, the capacity of the cloud may be considered as that of an isolated conductor to ascertain its potential and charge. Consider the cloud a spherical mass whose radius is 500 ft. or 15,240 cm, its capacity as an isolated sphere will be 15,240 c.g.s. electrostatic units. Assume, now, that there are two raindrops 0.252 cm in diameter per 10 cu. in., each contributing a charge of two electrostatic units to the cloud charge. In the spherical mass there are $9{,}047{,}808 \times 10^5$ cu. in. This gives as the quantity of electricity contributed by all of the drops within the mass

$$\frac{2 \times 2 \times 9{,}047{,}808 \times 10^5}{10} = 36{,}191{,}232 \times 10^4$$

electrostatic units.

Suppose, now, that this charge is distributed uniformly over the cloud sphere. Since

$$V = \frac{Q}{C} = \frac{Q}{r} = \frac{36{,}191{,}232 \times 10^4}{1.524 \times 10^4} = 23{,}747{,}527,$$

in electrostatic units of potential, the cloud's potential would be in round numbers 7,125,000,000 volts. It is evident that no such potential could exist and that a discharge must take place before all of the electricity reaches the cloud's surface. Successive charges accumulate and a series of discharges—that is, a multiple flash—takes place as described above. But, due to the influences named above, a uniform distribution is not possible and the potential at some points will be much greater than at others. It is easily seen that the raindrops in the above example would

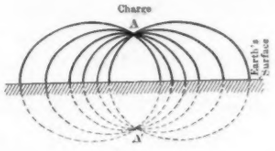


FIG. 1.—DISTRIBUTION OF CHARGE.

contribute sufficient electricity to charge the cloud several times to a very high potential.

It might be noted in passing that one must clearly distinguish between the potential of a conductor and the potential at a point due to charges. To illustrate, in the case of an isolated spherical conductor, the potential is $V = \frac{Q}{r}$, so that the smaller the value of r, the higher is the potential. The potential at a point due to charges q_1, q_2 . . . is $\Sigma \frac{q}{d}$, where d is the distance from the chosen point to one of the elements of charge and the summation is made between such limits as to include all of the charges. It is easily seen that as long as the total quantity of electricity remains the same, it matters not whether it is on large or small conductors, the value of $\Sigma \frac{q}{d}$ will not change if the average value of d is the same in both cases.

The capacity of a cloud to earth is often estimated by considering the cloud and earth as two parallel plates. By referring to Fig. 1 it is seen that the field is not uniform between the plates, so that the result indicated will be far too large. Still there is determined a high potential which could not exist, and thus there must be multiple discharges, in general.

Consider, for example, the quantity of electricity contributed by a cylindrical portion of the cloud, the radius of its base being 500 ft., and its height 1000 ft., situated at the lower surface of the clouds, where electromotive intensity would tend to repel all electricity to the lower surface of the cloud opposite the earth, and the attraction between the cloud charge and the earth's induced charge would exert a marked influence in increasing the density on this surface. Suppose that there are two raindrops 252 centimeter in diameter per 10 cu. in., each contributing a charge of 2 electrostatic units to the cloud charge. If all the drops contributed 2 units, we would have for the charge contributed by the whole of the cylindrical cloud mass $3.1416 \times (500)^2 \times 100 \times 1728 \times 2 \times 2 = 54{,}286{,}848 \times 10^4$ electrostatic units.

Suppose the cloud is 5000 ft. above the earth. To get an

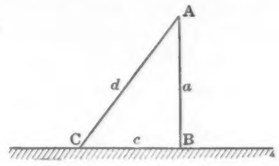


FIG. 2.—DIAGRAM SHOWING RELATIVE POSITIONS OF CHARGE AND CONDUCTING PLANE.

idea of the capacity of the cloud to earth we may use the formula $C = \frac{S}{4\pi a}$. This gives $C = 381$ electrostatic units. This value is too large, as the field of force between cloud and earth is not uniform. From the formula $V = \frac{Q}{C}$ we get

$V = 1{,}424{,}851{,}653$ electrostatic units $= 427{,}455{,}495{,}900$ volts.

In order to study the relative density of the induced charge on the earth's surface, take the simplest case, considering the cloud spherical in shape, so that its charge may be considered as concentrated at its center, and the earth's surface as a conducting plane. The lines of force will then be as represented by Fig. 1. The density of the electricity induced on a conducting plane due to a charge Q concentrated at a point distant a from it, is given by the equation $\sigma = \frac{Qa}{2\pi d^3}$ units per square centimeter, where d is the distance from the charge to the point of the plane at which the density is to be determined.

Fig. 2 is a diagram showing the relative positions of charge and conducting plane and also the distance d used in the equation

$$\sigma = \frac{Qa}{2\pi d^3}$$

The cloud charge is supposed concentrated at A, a point a feet above the earth's surface considered as a plane. C is any point on this plane, c feet from B and d feet from A.

Fig. 3 is plotted for the value of $\sigma = \frac{a}{2\pi d^3}$, Q having the value of 1, a value of 5000 ft. being assumed for a, the distance of the charge above the earth. It is seen that the equation $\sigma = \frac{Qa}{2\pi d^3}$ represents a family of curves.

Fig. 3 represents the relative density of the charge induced on the earth, considered as a plane conducting sheet, by a charge supposed concentrated at a point 5000 ft. above the earth's sur-

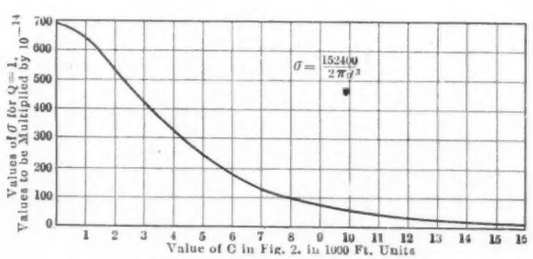


FIG. 3.—DISTRIBUTION OF POTENTIAL.

face. The abscissas represent the distance from the foot of a pendicular from the charge to the earth plane. The density falls off very rapidly, being only about one-tenth as great at 10,000 ft. from the foot of the perpendicular as at the foot, while at 4000 ft. it is about one-half. From this it is seen that the density of the induced charge does not become a small fraction of that

directly underneath a cloud charge supposed concentrated at a point until a point nearly two miles from the point directly underneath the charge is reached. As a cloud charge can not, in general, be considered as concentrated at a point, the point of negligible density will be farther away. Due to the unevenness of land, where hills and valleys occur, the curve of density will not be regular, but will have irregularities corresponding to the abrupt changes in the value of the distance from the charge to the point and in the contour of the surface. The presence of other cloud charges also modifies the distribution. This fact shows that the density of the charge on a transmission line does not reach a small percentage of the maximal value until a point nearly two miles from the point directly below the cloud is reached, and in the case of an induced charge of very great density the potential of the line will be so high when the charge is released that insulators may be punctured for some distance each side of the point directly below the cloud.

From investigations made by Dr. Walter in regard to the manner in which static sparks are formed, one is led to believe that probably a single lightning discharge may be divided into three stages, the establishment of the path from cloud to ground, the flow of the cloud's charge through this path and the disappearance of the flash. In establishing the path the discharge is of the nature of a brush discharge which starts from the positive charge and moves across the intervening dielectric with the velocity of light, breaking down the air, ionizing it, and establishing a conducting path from cloud to earth. The path of discharge forms a part of the cloud conductor, being extended downward with great rapidity. The successive points of the path, as the discharge reaches them, instantly assume an enormous potential, and, as the capacity of the path is very small, it is necessary that only very little electricity flow into the path to charge it to this high potential. Because of this enormous potential there exists a great strain upon the air directly in contact with the charge at the external surface of the path, as this is not conducting, which tends to the formation of branches or lateral discharges, so characteristic of this form of lightning. For this path to be established from cloud to earth, assuming the cloud to be one mile high and the brush discharge to move with the velocity of light, would require 5×10^{-6} seconds. As soon as the path is extended to the conducting sheet of the earth, as this cannot be raised to a high potential, there is a very great fall of potential at this point, which instantly extends back along the path, producing a steep potential gradient along the path, causing the lateral discharges to disappear, and a heavy rush of electricity to follow, draining the cloud charge and reducing the cloud potential at the point of discharge, so that the discharge ceases, and the third stage begins, it being the reverse of the first and consisting simply in the collapsing of the path upon the conducting sheet of the earth. If at a certain point of the path, two or more paths having practically the same impedance to the lightning discharge are available to ground, the discharge may pass to earth as a multiple discharge from this point.

As soon as the path is established from cloud to ground, the lines of force between the charges on the cloud and earth collapse upon the path and the charges rush along the surface of the cloud and earth's sheet toward the ends of the path. In flowing to this point the charge on the earth's surface will pass along the path of least resistance, which will be moist earth, water mains, if they occur in the path of flow, etc. It is evident that the discharge path will extend down through the surface sheet of the earth to an underlying sheet, if the latter has a much lower resistance.

It does not require as high a potential to establish the second and following discharges of a multiple flash, as these follow the path of the first, which has been ionized and is conducting. The luminous streak of highly heated air indicates that there is quite a resistance in its path.

No portions of conductors, whether earthed or not, such as large masses of metal, iron piping, etc., inside buildings, should be so installed as to lie near a lightning conductor, as they have electrostatic capacity, and a discharge will certainly take place to them, incidentally knocking a hole in the building and perhaps setting the building on fire. An instance is on record where a discharge burst through 4½ ft. of masonry to reach a gaspipe on the inside of the wall.

During a thunderstorm a person standing on the ground should not touch large masses of metal, as an iron ship or a penstock, unless these are thoroughly grounded. It is known that several men were killed by an induced charge while working on a ship in one of the navy yards.

There are two kinds of electric discharges which concern us here, the disruptive and the conductive. The disruptive discharge is sometimes spoken of as dielectric conduction. It is a discharge through a dielectric with the manifestation of energy. If the conductor is composed of material which has a high conductivity and is of sufficient proportions to allow a discharge to take place without too great current density, we have the requisite conditions for a conductive discharge. If the conductor is discontinuous at any point, so that a dielectric is interposed between the different portions, a disruptive discharge will take place through the dielectric, accompanied by the manifestation of enormous energy in the case of the lightning flash. The object of a lightning conductor is to predetermine the easiest path in that vicinity for the lightning discharge, and to change the charge from a disruptive to a conductive discharge from the point where it enters the conductor, thus preventing the manifestation of energy in the zone where it would endanger life or property. If such a protective device is to be relied on it must be installed with the greatest care.

Due to the suddenness of the discharge—i.e., the very great value of $\frac{d\,i}{d\,t}$ —every conductor has some impedance, whether the lightning flash is oscillatory or not. Investigation shows that discharges through a dielectric are oscillatory, in general. In view of this fact, considering the great length of the dielectric, compared with the conductor which the flash traverses in discharging, the extremely short interval required for a single discharge to take place, and the relatively enormous potential, it is probable that the lightning discharge is oscillatory. Alex. Larson gives the average time of a discharge in a multiple flash consisting of 40 discharges photographed by him as 156×10^{-4} sec. Comparing this interval with that required to establish the path it is seen that a single discharge extends over a relatively large interval of time.

The impedance which straight conductors may offer to the passage of heavy charges of high potential is due principally to their resistance and "skin effect." The best way to avoid this is to use conductors which have a large external surface.

It is interesting to consider what occurs on a transmission line when charged clouds are overhead. The charges on the clouds will induce charges on all conductors within the field of influence. Suppose a charged cloud is directly over a transmission line. This will induce charges of opposite sign on both line and conducting sheet of earth, the density being greatest directly underneath the cloud charge. If the line is supported on steel towers which are in contact with the conducting sheet of the earth, thus forming a part of it, and forming its highest points in that vicinity, the density will be very great at the top of the highest metal pins, and the line from these points to the nearest point of the cloud charge will be lines of maximum strain. As the transmission wire passes directly across the top of the insulator, it will pass through this path or line of strain. The density of the charge on the transmission line will be greatest at the point nearest the clouds, which will be at a tower, in general. An equal charge of opposite sign has been repelled by the cloud charge. A part of this escapes by leakage over insulators or by lightning arresters if it reaches them. Its distribution will be modified by the presence of other charged clouds which may be in a position to act inductively on the line, and every rearrangement of charges on the clouds will be accompanied by a rearrangement of the charges on the line setting up oscillations. These charges will also act inductively on the earth. The capacity of the cloud to the transmission line

is much less than that of the cloud to the conducting sheet of the earth, and so the cloud charge due to its high potential must ultimately reach the earth. Suppose that lightning strikes the transmission wire. The condition is then that of a condenser consisting of a line-wire and cloud and the conducting sheet of the earth, the latter terminating in a point separated from the line wire by a dielectric, consisting of a thin plate of porcelain, and maintained at zero potential, while that point of the former opposite the pin is suddenly raised to an enormous potential. The potential is sufficient to either puncture the insulator or arc over its surface. In the case of very heavy discharges of very great potential the insulator will be pierced and shattered.

Wooden poles considered as conductors have an enormous resistance and so cannot discharge freely. In this case the charge may spread some distance down the wire in each direction, giving rise to a very high potential on this portion and puncturing the insulators and shattering the poles as it passes to earth. This is especially true of insulators and poles before it begins to rain. This is easily seen from Fig. 3, the effect being to flatten the curve.

A cloud charge might be directly above a line at a spot where it would be necessary for it to pass some distance along the line before it could pass to earth. Such a discharge sometimes takes place, the charge passing to earth some distance from the point where it entered the system.

Such discharges in passing through the system must necessarily set up oscillations of the natural frequency of the line, as it comes to equilibrium. Since a lightning flash consists of many individual discharges, the recurrence of the above condition tends toward the formation of standing waves. If the natural frequency of the transmission line is such that the frequency of the lightning discharge corresponds to it or a multiple of it, a surge would result, and the successive discharges may be at such intervals as to have a cumulative effect, greatly increasing the magnitude of the surge.

Suppose the cloud discharges to some other point than the line. A heavy charge is suddenly set free on the line, the density and potential being greatest at the point nearest the cloud charge. An insulator at this point would be greatly strained and probably punctured. If a breakdown of insulation did not occur, providing a freely discharging path to earth, the charge would spread along the line, straining insulators, and entering the station, would pass over the lightning arresters to ground if they fulfilled their mission. In coming to equilibrium there is the formation of oscillations of the natural frequency of the line, as in the case of a direct stroke. It may be noted here that every discontinuity in capacity or inductance acts as a point of reflection in proportion to its magnitude.

From the above it is seen that two points are strongly emphasized in regard to protection from lightning, namely, a freely discharging conductor or arrester and good contact with the conducting sheet of the earth.

In the case of transmission lines, the aluminum arrester meets the requirements of a freely discharging arrester. In regard to grounds, they should present a large surface in contact with permanently moist earth, and every precaution should be taken to prevent their drying out, due to repeated service.

Lightning conductors installed on towers and overhead ground wires assist in conducting the lightning to earth without its penetrating the transmission system.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Lighting Development at Boonton, N. J.

The Boonton Electric Company, of Boonton, N. J., instituted a 24-hour service on Jan. 1, 1909. The company, which has recently changed owenership, serves a hustling manufacturing town of about 6000 inhabitants, and is pushing a vigorous campaign for the betterment of its service and for obtaining new business. Flatirons, hot-water heaters, and all other electrical household conveniences are being introduced; and the coming summer will see a large number of fans and signs in use.

Rates for light are low, being only 10 cents per kw-hour, while in addition free renewals are given on all standard lamps. The company gives to its patrons free expert advice on illuminating engineering, and is already making several model tungsten installations. An effort is being made to straighten out the daily load curve with a larger motor load, and already success in this is assured. The company quotes a very low sliding rate to power users, provided they "keep off the peak," which, except on Saturday evenings, is comparatively short.

Besides the commercial load, which is handled by 1100-volt feeders, the streets of Boonton are lighted by the company with 6.6-amp series alternating arcs in the center of the town, and with 3.5-amp series incandescents in the outlying sections. During the present year many changes and improvements in equipment are planned to enable the station to carry its daily increasing load.

Electric Light Situation in Central New York.

BY WILLIAM H. STUART.

Central New York towns as a field for new business differ somewhat from towns in other sections of the country. While they are for the most part manufacturing centers, they are unlike New England manufacturing towns, for instance, in that they are not dependent on one or two large industries, but possess a number of smaller and varied ones. The class of labor employed is skilled and commands higher wages than is the case in New England. This in itself broadens the field for the introduction of electricity for lighting and at the same time does not narrow it for motor application.

The problem of securing new electric lighting business has been affected by at least three general conditions that have exerted considerable influence for and against its success. First, is the utilization of water power; second, the entrance of several hydro-electric companies into the transmission and distribution field, causing sharp competition and bringing about a reduction in rates; and third, the recent financial depression, which caused an almost complete abandonment of new business departments and work. These conditions brought about grave situations in addition to those obstacles characteristic of each locality which had to be overcome.

The hydro-electric developments, notably in the western portion of the state, where Niagara power is available, have reduced the operating and production expenses so as to allow the marketing of the energy at a price within the means of all. Gas is replaced entirely by electricity. In one city of 30,000 inhabitants the following conditions have been brought about by Niagara power, combined with good business methods. Gas is used only for cooking. The gas company has 202 consumers; the electric light company has all the rest. There are 1800 electric flatirons in use and a dozen gas-irons. In the small hotels and in one or two larger ones the alternative to the electric light is a candle, not a gas fixture being installed. The streets are lighted by arc lamps or series incandescent lamps. In an endeavor to create a demand for gas as an illuminant the gas company installed so-called gas lamps free of charge. The lamps were used for the heat that they gave, and the company was requested to remove them after a short time. The stores are illuminated entirely by electricity. The electric light company has not pushed cooking appliances, deeming it advisable to wait until electric cooking has been brought to a point com-

parable with gas as to price and service, although there are connected a number of electric cooking utensils. The methods employed by the company are aggressive and progressive. Besides being able to sell energy at a low rate, the company employs every means in the trade to get business. One of them is getting new houses wired and electricity used by the occupants. When the building department issues the permit a representative is immediately sent to the owner to induce him to wire the proposed building. Should a person build, say, a two-family house, all arrangements are made to have the house wired and just as soon as the wiring is complete a meter is set. No charge is made the owner of the house for energy consumed from the time the meter is set until an occupant is found. The amount of energy used is charged to advertising. The company has found that the light is not wasted by the owner, and it adds to the attractiveness of the apartment when it is viewed by a prospective occupant. This has proved a very profitable plan, as it guarantees the use of electricity, pleases the landlord, helps him show the premises, encourages the leasing of them and the owner in return takes pleasure in recommending that electricity be used and goes into detail in explaining the advantages of such service. Another scheme of the company is to encourage the installation of a small transformer, costing about $1.25, to operate the push-bell systems in the houses. The revenue from this use of electricity amounts to a very, very small item, yet it demonstrates the company's motto that nothing is too good for the consumer, and further impresses upon the consumer the many side uses of electricity.

In another section of the state a large hydro-electric company started with the primary object of supplying central stations with energy, but failing in some cities to drive a bargain, was compelled to enter the field to secure a market for itself and compete with the established companies for business. After securing a franchise and permission to do business in each city, this company immediately extended its high-tension lines and built a transformer station and strung wires through the streets of the city. The inducement offered by the hydro-electric company to the general public and to the customers of the established company was an offer to supply energy at whatever price the consumer would offer to pay. By this means it secured all the business that could be obtained off hand. The regular rate of the established company was 12 cents per kw-hour and to meet the operations of the new company they cut the rate to 5 cents per kw-hour and the new company immediately established its base rate at 5 cents, but gave a graduated scale of prices, depending upon consumption only, which brought the rate very low. These were the tactics employed wherever the hydro-electric company went. Naturally enough the amount of business done by both the old and the new companies in each locality was large. But the main proportion of business done was that which could not be accepted under normal conditions. Matters went on in this way until both companies, finding that they were playing a losing game, made overtures and agreed on a return to the old schedule which was in force before the competition started. In one city a curious situation developed. The business of the old company increased when the rates were raised to the old schedule from the very first month. During the first month of higher rates the old company cut off 17 consumers who could not afford to pay the rate and 19 new consumers were added. The 17 consumers cut off during the first month was the only loss sustained by the old company. Its average gain of new consumers from that time on was from 20 to 30 per month. These were customers of the hydro-electric company who felt that it was responsible for the increase in rates and that they might as well pay the money to the old company, which had suffered by the attack, rather than to the one which caused the disturbance. It is estimated that the hydro-electric company lost about 200 consumers during the first month of high rates, showing that the customers obtained by it were not very desirable, but had been attracted by the low rates. All sorts of methods were tried by the companies to obtain business when both were on an even footing. In one of the cities affected an amusement concern opened a large moving-picture show. The management applied for rates from both companies and decided to become a customer of the old company at regular rates. Upon learning this the other company made a proposition to the amusement company to the effect that while it could not agree to give it a lower rate, owing to a working agreement with the old company, yet, it would set the meter 30 per cent slow and thus the company would be able to use the energy at greatly reduced cost. This proposition was accepted and the amusement enterprise became a customer of the new company. When the first bill was received it was considerably higher than expected. The amusement people called in the managers of the old company and asked that they test the meter for them. The result of the test showed the meter 7 per cent fast instead of 30 per cent slow. On the strength of this the new company lost the customer which the old company gained. Methods of this nature have prevailed and had it not been for the honest and fair treatment of the public by the old company the business would have been entirely discredited. In their fight the old companies have only advertised the latest rate for energy, as they believed that the new company would receive as much benefit from a general advertising campaign as they would themselves. The effect of this competition has been that while the gain in the number of consumers has been considerable, yet the lowering and raising of the rates and number of free things given to secure a consumer, such as signs, motors, fixtures and wiring, now all done away with, has not produced a desirable effect, in that it has brought out consumers of the something-for-nothing type, and those who are always delinquent in the payment of bills. Considerable time will be required to weed out the undesirables and allow the companies to work on a sound business footing again.

The recent financial depression affected the electric lighting industry just the same as it did other business. The first department to suffer was the new business department. In some of the larger cities, where a force of 10 or 20 men was engaged in getting business, the number was cut down to one or two. All advertising was stopped. This condition obtained until this fall, when many of the companies re-engaged their entire force, continuing the work that was stopped. Others have at least one-half of the force at work at present and expect to resume former conditions shortly. A feature of the depression was that while the companies cut off entirely their new business work, and did not seek any business, the amount of business disconnected because of the general business depression did not in any city amount to much. In fact, the regular and usual loss due to moving, etc., each month, was not greatly exceeded in any one month during the past year, so that the central stations had practically no loss of business.

The rates on the whole, throughout the state, are uncommonly low and there are to be found several companies that work on a maximum demand scale. Flat rates are also to be found, but are only used in combination with the meter rates for special classes of service. The companies using these rates are gradually working away from this method of charging. The Saratoga Gas, Electric Light & Power Company has recently changed from a straight flat rate to metered rates in a small town which it supplies. The company did not issue a general statement, but after giving notice that such a change would be made, went to a hotel having a large connected load and set a meter on trial. The meter was read weekly and showed that the monthly bill by this plan would amount to some $150. This load netted $25 per month on a flat rate. To ascertain where the energy went, an examination was made. In the coal bin, closets, cellars and outhouses, 32-cp lamps were installed where 4-cp lamps would be sufficient. Moreover, the lamps were left burning from the time they were placed in the sockets until the filament broke. These were all replaced by lower candle-power lamps and were used only when needed. By such methods the bill was reduced to about $30 per month. The other consumers were all handled in this way and the system was quickly changed over without the loss of a customer.

Following is a list of the base rates in use in some of the cities:

Saratoga Springs, 13,000 inhabitants; rate 11 cents to 5 cents per kw-hour; sliding scale, based on consumption, 1-kw to 800 kw-hours.

Albany, 100,000 inhabitants; rate 10 cents to 3½ cents per kw-hour; sliding scale, based on consumption, 1-kw to 10,000 kw-hours.

Amsterdam, 28,000 inhabitants; rate 5 cents per kw-hour, with discount for prompt payment.

Little Falls, 12,000 inhabitants; rate 8 cents to 3 cents, sliding scale, based on consumption per connected equipment with a discount of 2 cents per kw-hour for prompt payment.

Rochester, 200,000 inhabitants; rate 8 cents to 2½ cents, sliding scale, based on maximum demand or daily use of connected load.

The advertising done by the companies has on the whole been thorough. Extensive campaigns of from one to two years' duration have been operated with success. Various schemes apart from a general routine were used, follow-up letters, small catchy prints, newspapers, car advertising, bill boards, signs and exhibits at fairs, etc., were all tried and played important parts in building up the business.

The show windows, rooms and spaces are all in good order and up to date. Where some of the companies have to make a combination display of gas and electric goods, the electrical appliances have an equal share in the display. In the city of Rochester, the Rochester Railway & Light Company has one of the finest show windows and display spaces to be found anywhere. The equipment consists of two very large show windows, one each side of the entrance, a large floor space immediately adjoining, and a goodly sized basement, light and airy. The windows are utilized for a general display of appliances, and also as a practical demonstration of the best methods of window illumination. The floor space has the gas heating and cooking units. The basement contains a fully-furnished, four-room apartment equipped with every available electrical appliance, connected up for practical and immediate demonstration. There are one or two companies in the state that do not handle an appliance or fixture, leaving it all to the contractors, and this idea has been followed up so that the contractors carry an elaborate stock and take means to display it. To get the contractor to pay attention to this end of the business the companies had to work up enthusiasm and keep it up by holding meetings, etc., and helping the contractors along in every possible manner. Some very fine displays have been thus obtained in three or more parts of the city, generally on the prominent thoroughfares where travel is greatest. The wiring and general installation work have been brought up by this co-operation to the highest point of efficiency.

All the companies are looking forward to a record-breaking year from January on. They have all been quietly at work laying out plans for a fresh, vigorous and systematic business campaign. Some of the methods in use heretofore will be discarded and new ones tried.

INTERIOR WIRING AND ILLUMINATION

Use of the Words Wire and Cable.

There has been and is a continual misunderstanding in the accounting departments of large contracting firms, supply houses, central stations, etc., as to the words "wire" and "cable." The line department, for instance, of an electric light company will report that it has on hand so many feet of cable, leaving the purchasing department to guess what is meant or to request more specific information. In order to simplify matters one large company has restricted the use of the word cable to lead-covered conductors used either overhead or underground. The word wire is used to signify all conductors which are not covered with a lead sheath. In making entries for orders on the storehouse and in reporting material used on return work orders, care is taken to specify whether it is wire or cable, giving the insulation and size, such as for example, 500,000 circ. mil, stranded, weatherproof wire, or No. 6 stranded, rubber-insulated wire. Inasmuch as rubber-insulated wire is sold by the foot, the report is made to state the number of feet of such wire. Weatherproof wire being sold by the pound, the quantity wanted or in stock is given in pounds. The reports or requisitions specify the number of feet of cable on hand or required. By this means all misunderstanding is avoided.

Concealed Knob and Tube Wiring.

Although in many cities of the first class, concealed knob and tube wiring is no longer permitted, owing to municipal ordinances prohibiting it, this old and original form of wiring is extensively used in non-fireproof buildings throughout the country. There are superior methods of construction from a mechanical as well as an electrical viewpoint; but these methods are very much more expensive and if the industry is not to be retarded, the cheaper method of wiring must persist so long as no hazard is involved. That safe knob and tube work can be and is installed is evident from the code rules covering such installations, for were there any extra hazard involved, the underwriters could be relied upon to wipe knob and tube work out of existence. There can be no doubt that in many cities the elimination of knob and tube work has been detrimental to the installation of electric circuits and hence to electrical interests. The high first cost of wiring dwellings is in the majority of cases the only reason for the non-use of electricity in such places. The cost of electricity is now so low that there is none so poor but what he can afford to use it; the installation cost is the only drawback. As showing what can be done in the way of wiring a building in approved fashion and yet at reasonable cost, a dwelling so wired may be cited. This is an eight-room cottage costing about $4,500. It is wired for thirty-one outlets, including switch openings, and has five circuits with eight lamps on each circuit. Inasmuch as 12 lamps are permissible on a circuit, it is evident that extra outlets can be provided if this is found to be necessary. The owner was well advised in arranging for this reserve, and where first cost is kept down no reserve is ordinarily provided. The total cost of the job, including everything except the fixtures was $65. Fourteen hours were required to make the installation, and the labor cost was $7.84, one journeyman and a helper being employed. Only the best material was used. Every outlet was equipped with an outlet box or plate. There were two three-way circuits and the workmanship was up to standard, the installation passing inspection without a violation. Were there one circuit less, the same number of lamps could be lighted and the price per outlet could doubtless be brought below $2. It is questionable whether the cost of such an installation could be made much lower. If builders of cottages costing $4,500 could be assured that the latter could be wired for electricity at a cost of approximately $2.50 per outlet, it is safe to say that every new cottage within reach of electric light mains would be wired. Ordinarily, however, the cost per outlet is many times the figure given.

Standard Electric Wiring in Small Towns.

BY W. J. CANADA.

The larger cities of the country are very generally making an organized effort to reduce the electrical fire hazard. In too many, of course, the inspection of wiring is of a perfunctory character, but in this wiring inspection shares the same fate as building restrictions in these same cities. This is a result of municipal politics, usually, which will disappear when building restrictions become embodied in State laws, and their enforcement placed in the hands of a State civil service. There are indications that this question is much nearer settlement than ordinarily supposed, and bills are under discussion before several State Legislatures placing inspection of electric wiring in the hands of a State board.

But the smaller city has been the place where any attempt to secure adequate supervision has met with insurmountable obstacles. Infrequent inspections from outside sources, generally by the underwriters, while they have done their part, have not much improved the general wiring conditions of the small city. Where frequent inspections have been made possible by arrangements to cover the expense of the inspector it has been by virtue of an unusual personality on the part of the inspector, and even in these instances much wiring is uninspected and defective. The inspection by a local contractor or by a lighting company's foreman, is ordinarily productive of nothing more than jealousies, suspicion of unfairness and petty graft. It is evident that none of these methods has solved the problem for the smaller city, or is the problem in any respect on the road to solution. Not the least discouraging feature in this connection is that the property owner and city official see this defect clearly, accept it as a necessary evil, and scout all attempts to institute a better system. This is all because the matter of restricting wiring has never been fully presented. The hazard of defective wiring is not fully known, the standard to be followed is vaguely defined, and the choice for inspector is the climax of the parody. It seems as if by the time it came to the appointment of an inspector all enthusiasm had failed and the first applicant had been welcomed.

It is true that conditions in small cities often appear thus hopeless, but as in many States small cities are quite numerous, and the betterment of their building conditions can hardly be considered of less value than that of still smaller centers of population. By just the degree that conditions in the small city are worse, by just that degree should standard wiring throughout it be desirable. For a score of years the underwriters have been the principal force back of efforts toward improvements tending to reduce fire losses from defective wiring. To be sure they find insurance more profitable with safer buildings, but rates become automatically lower, too, so that the profit is divided with the public. The work of the underwriters is met with frequent opposition, and ends in limited success, but construction is at least somewhat better as a result of the effort.

The Rocky Mountain territory has been obliged to face the problem presented by the small city very seriously, as it is a region of small cities, much scattered and with the difficulties of effective wiring supervision enlarged in the same degree. Organized efforts for better wiring had for a long time presented such an expense in this field that the underwriters had not attempted any general campaign. The rapid growth of these cities has, however, made necessary some recognition of the electrical fire hazard, and a campaign formulated, which has had very remarkable results, illustrating the effectiveness of well-considered movements of this kind.

A number of wiring installations are taken up with building owners, the defects pointed out, and these defects shown to be the natural result of carelessness or unregulated competition. The fire hazard and life hazard are dwelt upon and the whole difficulty is demonstrated to be due to lack of an enforced standard of safety and permanency for wiring construction. Indignation, somewhat vague in direction, but very real in quantity and quality, is the result. The property owner's next mark for dissatisfaction is the contractor. He, however, is usually gone, or he very capably demonstrates that competition entirely unregulated has forced him to adopt such poor wiring methods. Rarely does he attempt to justify such construction on the ground of sufficient safety; the few who do generally fall into public disrepute. Sometimes it is the public's belief that all things considered the lighting company is probably responsible for all the trouble; its rates are extortionate and it has frequently neglected to send men out when lamps failed or fuses blew. And most of all, the lighting company, with all the trust reposed in its consideration for its welfare by an over-confiding public, has never given it the least hint that its wiring was faulty and might possess fire hazards. Of course the fact is the lighting company has frequently stated that the building wiring was of too light capacity, and its connections probably unsoldered; but this was laid to the company's desire to shift responsibility from its own shoulders for dim lights and poor fuses, and the whole matter was soon forgotten. The lighting company which has been so short sighted as to do wiring in such a city is now in the most desperate difficulties. Many of these are deserved, for it should have weighed its responsibility for wiring in standard manner before entering the field. Its original idea has been occasionally the betterment of wiring, in which case the difficulty is not insurmountable and the lighting company is soon fully accredited as a co-operator with the now fully awakened public. Where the lighting company has entered the wiring field to cheapen construction below reasonable limits, in order to increase its load and consequent revenue, a certain revenue being of course indispensable, and sometimes difficult to get—or where mistaken economy of the service company's management employs a careless or ignorant wireman because of his cheapness—in either case, the lighting company is in a dilemma. It cannot plead ignorance, for it should possess knowledge. It cannot plead necessity in competition, for that is an admission of purposeful neglect for safety in construction. It will generally be found advisable for such a service company to plead the difficulties of procuring standard material or good workmen for prevailing wages. These arguments have at least the flavor of truthfulness, and may enable the lighting company to enter the movement with a cheerful countenance and a trumpet which may drown invidious remark.

All these stages, with the various undefinable and unpredictable complications by which each city displays its individuality, are now past. The interest of property owners, of contractors, of service company, is all secured, and the underwriters must maintain and direct this public interest to the end that it shall be able to perpetuate itself in concrete, visible form as a force in the community. Delays and mistakes are avoided and the fullest effectiveness secured when the underwriters retain some guidance of the movement until its culmination.

In this connection it is to be noted that the life hazard of electric wiring, while comparatively not great, is still such as to render its discussion advisable, and on this basis the underwriters are without direct interest. Still, the contractor and the lighting company have never called attention to this life hazard. They have feared to breathe a suspicion of such danger, with its possible reduction in electrical applications. If deaths or injuries have occurred they have been so skilfully and efficiently submerged in the passing affairs that the public has failed to raise a question and the accident is soon forgotten. By this method there prevails a general ignorance of causes and means of prevention. Brass shell, key socket, flexible cords, exposed contacts, and like life hazards, must be openly opposed. Concrete examples of injuries and deaths may be used with discretion. Construction is thus given its proper tendency toward regard for life as well as property.

The desirable form for securing permanency in restrictions, now so certainly needed by an enlightened public, seems to be the ordinance. Here, too, guidance is advisable, and not wet blankets. The ordinance is not necessarily the solution. The inspector is the very vital part. Manifestly the manager or foreman of the lighting company or the wiring contractor are not available; nor can the city afford living wages for a man of proper electrical knowledge and business ability. A paid fire chief may be the very man, or an electrical employee of a large manufacturing concern, not catering specially to that city's trade, is often available. If he is young, ambitious, honest and possessed of a business head, he is the man.

But all this preliminary arrangement raises the question of the need of an ordinance or the expense of $25 or so a month for its maintenance, if the underwriters' inspectors follow up the work satisfactorily. Experience has shown, however, that an ordinance is desirable, and with an inspector, assisted by the underwriters, the ordinance should be very explicit. If the inspector maintains his integrity and his interest, a thing entirely reasonable for an individual given a particular duty to perform, and if the inspector is the result of careful selection, substantial and safe wiring can be reduced to a system which

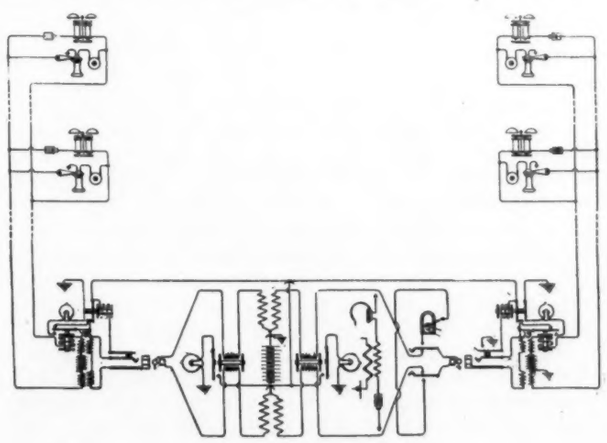
can be expected to keep on a good level, and even to better itself as the art advances.

By this means the small city can be placed in a condition where it demands and receives standard wiring as well as the larger city. The ordinance need not be long, it should preferably be very short, since it must be printed according to law. It need consist only of the establishment of the standard, the creation of an inspector, the forms for notification for all interested parties, and the penalty for violations of the ordinance. The standard will naturally be the National Electrical Code, with some greater definiteness in certain rules, such as definite requirements for grounding secondaries, and for maintaining reasonable spacing between lighting and other wires. In securing an ordinance of proper working form, adapted to the city's necessities in minor matters, but with the essentials always the same, the underwriters should be consulted, since they have held the same relations with other cities and are otherwise equipped to assist in the matter.

It is not to be supposed that for such effective diplomacy there are no prerequisites. The representative of the underwriters must first possess tact in abundance, and business directness of that kind which must always be employed to carry a matter to its conclusion. But he needs other qualifications. He must have a sufficient knowledge of the relations of tenant to owner, to foretell their attitudes on rewiring costs and operating costs accurately, and bring them together on some proposition. He must advise with the city government intelligently, must arouse its interest and enlist its active co-operation. He must appreciate the warfare of the electrical contractor with continuous or occasional unfair competition, and understand the contractor's wiring costs and soliciting difficulties. He must know the costs of producing energy, the franchise agreements, and the different business policies of lighting companies. He must be on technical and business equality with all these conflicting interests, and be able to harmonize them on a common ground, at which they by themselves cannot arrive. The smaller city is becoming a city of safe and permanent wiring, just as rapidly as such campaigns are conducted for those conditions. But there is in this work still another uncrowded field in which the underwriters may exercise their activity, with the certainty of better relations with the public and reduction of the fire waste as their inducement.

New Telephone Patents.

Mr. W. W. Dean has obtained a patent for an improved busy test circuit for a two-wire multiple switchboard of the Dunbar



DEAN TELEPHONE SYSTEM.

type. A test relay of high resistance is arranged to control the current in a tertiary winding of the operator's induction coil. One end of the winding of the relay is connected to ground, while the other is connected to a common point from which the circuit branches in multiple to all cord circuits of the position. These circuits reach their individual cord circuits through, first, an auxiliary listening key contact, and, second, through the contact of a relay in the particular cord circuit. It will thus be seen that the busy-test relay while common to the position is limited definitely at any time to the cord circuit actually being used for testing.

Another patent granted to Mr. Dean covers a switchboard system designed to be "clickless." To this end the cut-off relays are made two-stage. The first operation controls the line lamp and the second the battery supply circuit. The resistances of the calling and answering cord circuits are not the same. When the latter is used the cut-off relay completes only a partial action, extinguishing the lamp and leaving the battery top unbroken. There is thus no click upon the line and as there is no ringing to be done, the battery top is not harmful. The low-resistance cutting cord, on the other hand, causes a complete action of the cut-off relay. No click is made, however, as the circuit is at this time open at the station, which has not yet been called.

Another system by the same inventor is shown in the accompanying illustration. It will be seen that the differential supervisory relays receive equal currents in both coils, as long as the local line relay is energized. When this drops off, however, a ground connection is so introduced as to unbalance the corresponding supervisory relay. All three of the above patents have been assigned to the Kellogg Switchboard & Supply Company.

LETTER TO THE EDITORS.

Droughts; Also Floods and Freshets, and Water-Power Plants.

To the Editors of Electrical World:

SIRS:—More may be said on the above-named subjects than is contained in your number of Jan. 2, 1909. Some German philosopher has remarked that "one of the principal teachings of history is that the teachings of history are not heeded in the affairs of men." In other words, each generation appears determined to educate itself by its own experience, and is disinclined to reason from the experience of others who have gone before. This is as true in matters of water power as in any others. Water-power engineering, constructing and administration is at least a century old in the United States, referring now to large water-power companies and factories driven by water power, rather than to saw and grist mills; and yet when water power came to be used to generate electricity, there came with it a seeming desire to treat it as a new art, by new men, many of them new themselves in any business, unless it was the design or management of electrical machinery. And so we have curious theories about building water powers to utilize only the lowest recorded run of a river; about primary and secondary power, and much more of the sort, all a matter of settled practice for not less than 50 years in any of the old-time water-power regions of the country.

I was brought up as an hydraulic engineer—my schooling and professional study once done with—in the office of James B. Francis, agent and engineer of the proprietors of locks and canals on the Merrimack River, at Lowell, Mass., and have followed that branch of the profession of civil engineering something over 40 years, including 10 years of administration of the water power of the Holyoke Water Power Company, at Holyoke, Mass., together with the construction work needed there during those 10 years; and as a result, have the following views on the subject matter of the Jan. 2 article referred to:

If one goes up or down some mill-stream that has been in use at numerous mill sites for a century or more, one finds the capacity of the water turbines set up at the several mill sites

not to vary inordinately with respect to the quantity of water flowing in that stream. This last, it is true, itself varies from day to day throughout the year, and varies greatly, but its graphic presentation can be reduced to some degree of regularity by a very simple expedient, of which more presently.

The middle, or practically useful, discharge of the river on such streams is determined, or at the time mentioned will be found to have been already determined, by a kind of "survival of the fittest" process, as applied to water wheels and water turbines. If the wheel capacity put in by any one mill owner is, or has been, too small, then, in the course of years, too much power is wasted over the dam, and more wheel capacity is or has been added. If too much wheel capacity ever has been put in, in the course of years some of the wheels stand idle too long and before long they go upon the scrap heap.

Now, what is this practically proper wheel capacity and how is it to be determined at any mill site?

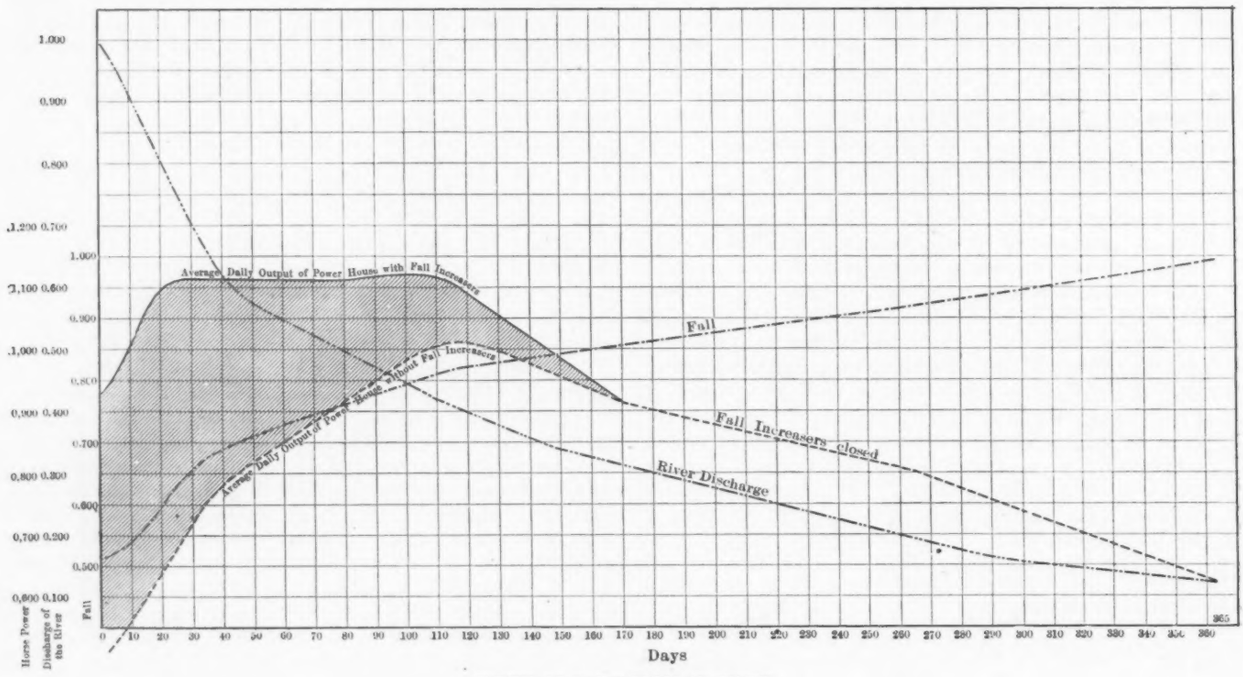
The discharge or flow of any river at any particular point when represented by a diagram showing the daily flows in consecutive order as they have been observed, is a most hopeless looking curve, using the word "curve" in its mathematical sense of a line that connects the ends of ordinates erected on abscissæ. But it can be converted into a sufficiently regular curve for purposes of power computations by the simple expedient of rearranging the 365 given quantities for any one year in the order of their size; the greatest or maximum flood flow as an ordinate on the first day; the next largest flow as the second-day ordinate, and so on down to the lowest day's flow for that year on the 365th day. (See diagram; also see a paper by the present writer in the 1907 *Transactions* of the American Society of Civil Engineers, on "Twenty Years' Run-off, at Holyoke, Mass., of the Connecticut River," in which the data for 20 such curves, representing the flow of the 20 years, 1881 to 1900, arranged in this manner, are tabulated.)

In such a curve or tabular column there will always be one day's flow, than which there are 182 that are greater, and 182 that are less than it; and, according to my observation and experience, it is this middle day's flow which represents the wheel capacity for which *it pays* to buy wheels or turbines, and dynamos, and to build wheelpits, power house, head penstocks and tail races.

This is not a hard and fast rule, and in the nature of things a hard and fast rule cannot be set up, but it will serve. Consecutive years will not show the same "middle quantity," and the attending circumstances can and should be caused to allow of a moderate variance from any such middle quantity found. Instead of 182 days' flow in the year less than the selected quantity, in certain cases, some 200 or 210 such quantities may be taken off before the daily flow representing wheel capacity is reached; but it will be found that such a procedure will not greatly add to the normal middle capacity first above described. At Holyoke, the range of all the middle quantities, on the 183d day, *for 20 years,* for 8144 sq. miles of drainage area, was from 5125 in 1880 to 13,220 cu. ft. per second in 1890, with a least daily flow, during the year, varying from 1600 in 1884 to 3650 in 1887, and a greatest day's flow varying from 115,000 in 1895 to 37,800 cu. ft. per second in 1889.

When more than one year's flow is thus taken as a guide, no arithmetical averages should be taken, but instead, after plotting all the records available, a middle and two enveloping curves may be drawn, which will give the middle curve to work from, and the two curves that will indicate the variations from the normal condition of things that may be expected to occur in the course of years.

Having thus found the curve that shows the future probable flow in the river, on each day of the year, we next draw a curve



CURVES OF DAILY FLOW OF WATER.

showing the *fall* that is appurtenant to or goes with the daily quantity of flow in the river on each day of the year. (See again the diagram, curve marked "Fall.") In times of freshet or flood this fall will be least; in times of a low flow in the river it will be greatest.

From these two curves of flow and of fall, the curves of daily available power output of the power house may be computed and drawn, as on the diagram curve marked "Average Daily Power Output Without Fall-increasers."*

Generally, or roughly, speaking, such a curve of power output will vary from half the normal, or middle, power output, at low water in the river, to the normal, or greatest, or middle, output in the middle of the year; by reason of a lack of water enough each and every day to keep the power output of all the wheels, all of that time, and this full output hardly reached, it will again gradually fall to about one-half of the full output by

*This diagram, made for an actual case, represents probably—the full computations have not yet been made—the case of a water-power plant having slightly more wheel capacity than is most economically proper; having regard to cost of power house and water connections, turbines, dynamos, etc.

reason of an excess of water making the "back water" on the wheels; that is, diminishing the fall for the remaining half of the days of the year. Against the first-named low-water situation there is no practical remedy in the vast majority of cases except the addition of heat engines of some sort, steam or gas.

What the future may bring forth it is difficult to say. But so far, storage of water in reservoirs, to be fed down for power purposes during low flows in the year, has not proved a brilliant commercial success that I ever heard of. It had a fair trial on the Merrimack River under favorable topographical and financial circumstances, Lake Winnepesaukee furnishing the reservoir capacity and the management being vested in the well-manager water-power companies situated at Lowell and Lawrence, Mass., with the result that, after many years of operation of that reservoir, its use as a reservoir by those water power companies was abandoned. Wherefore I have said that against a diminution of power output by reason of a lack of water the proper remedy was the use of heat engines, and to this I will refer again.

Taking now the other half of the days of the year, with a power diminution caused by too much water, a complete remedy may be had by the use of the fall-increaser. This apparatus will keep the power output at its full quantity for the days named, by the use of the water which otherwise would waste unused over the dam, and will do this at a construction cost of only two or three years' value of the power it has produced, with practically no increase in operating expenses. (See again diagram, marked "Average Daily Output of Power House with Fall-increasers.")

If now heat-engine power is to be taken to raise the varying output of power during the low-water half of the year to a uniform full-power output (one that would be shown on a power diagram by a horizontal line), it is evident that such heat engines should have a maximum daily capacity of about half the full power output, if this full output is to be maintained strictly every day in the year. The kw-hours they will be called upon to produce will range from half the average daily load, on the driest day of the year, down to nothing at all on the middle day of the year, or for the year one-eighth the annual full output of kw-hours, roughly computing, or 10 to 12 per cent.

The cost of this one-eighth annual power output will be the interest on the first cost of the engines, plus the necessary fuel and partial attendance, the other part of the attendance being furnished by the attendance needed in the power house during the rest of the year. Now by far the greater part of this cost consists of the fuel cost, which stops when the heat engines stop, and diminishes as this supplementary power output diminishes. For this reason the use of supplementary heat-engine power was well developed not less than 50 years ago, and only the uninformed may find anything novel or startling in such use. It should be considered *the rule* to use such power as a proper supplement to most any water power, the power houses on rivers which are the outflow of the Great Lakes or of other great lakes only excepted.

So far I have been speaking only of average daily outputs of power. It is the office of mill-ponds, or comparatively small and contiguous reservoirs of water, to enable the plant to furnish during the low-water half of the days of the year the required variation in power output during the 24 hours of the day, or the peak load, which they ordinarily can easily do. And this consideration changes nothing in what has already been said.

I agree with your editorial that at the present stage of the development of power production what the consumer demands, and should be offered, is primary—or giving it its long-established name—*permanent* power. And I have endeavored to show how this can be readily accomplished by the supplementary use of heat engines, and of the fall-increaser, at a minimum of cost per hp-day or kw-hour of annual power output, and that this method of producing such permanent power (barring only the use of the fall-increaser, only recently made available for generating about one-eighth the annually needed full output of power, by utilizing water otherwise wasting over the dam) has been well understood by competent hydraulic engineers certainly for 50 years past, and has been common practice.

It is idle to seek to avoid the development of water powers of which so much has been done during the past 20 years. What with the certain and continual advance in the price of fuel, its possible occasional scarcity by reason of coal strikes or interruptions to its regular transportation, until the final day when all fuels for generating power shall have become exhausted, we may look forward to a time within a measurable distance, say, during the lifetime of our grandchildren, or else our great-grandchildren, when water power will have become the chief reliance for the generation of power throughout the areas of the earth.

A body of estimable gentlemen, located all of them east of the Alleghanys, may during the drought of 1908 write such letters as are printed in your issue of Jan. 2, but these same gentlemen, three months later, will probably feel very differently upon their daily outlook, and if approached with a similar inquiry would probably write a very different letter. They are the "foolish virgins" of the parable, and of the power producing community, and need not have again the experience they have just had or are yet having if they will exercise skill and forethought, nor need any member of the power-house sorosity have their experience.

As your correspondent views the situation, power houses should be built to sell permanent power only (no secondary or "surplus power"); they should not sell what they have not got, and they may, by the exercise of a proper skill and of forethought, meet all commercial demands for power likely to be made upon them severally.

NEW YORK. CLEMENS HERSCHEL.

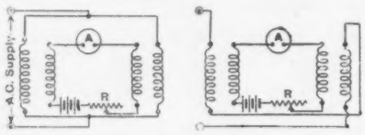
DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Transformers as Choking Coils.—J. D. COALES.—A paper read before the Birmingham section of the (Brit.) Inst. Elec. Eng. The author describes a method whereby ordinary transformers could be used as choking coils for the purpose of testing alternators on inductive loads. In attempting to separate the inductive and resistance components of the "drop" in alternators on load, it is necessary to apply an inductive load about equal to the full-load current of the alternator under test. The smallness of the no-load current renders a transformer useless as an inductive load at the voltage for which it is designed unless by some special means the no-load current can be increased to a reasonably large value. In core transformers with butt joints this may be accomplished by temporarily opening the joints between the limbs and yoke, and inserting distance-pieces of non-magnetic material, but this is not always convenient. To provide choking coils for such a purpose is generally too costly, especially in the case of large alternators. If, however, the alternator is provided with transformers, either for stepping its voltage up or down, or both, the test may be easily carried out by the method described in the paper, which permits of a reduction of the permeability of the core of a transformer (thereby increasing its magnetizing current), without any interference with its construction. Briefly, the method consists in bringing the flux density of the core to a high value, by means of direct current sent through the secondary winding; so that when an alternating electromotive force is applied to the primary, the flux density undergoes variations about a mean flux density corresponding to low permeability, instead of about zero flux density corresponding

to high permeability as is ordinarily the case. Something must be done to prevent the electromotive force from driving an alternating current through the source of direct current. Two ways of doing this are shown in Figs. 1 and 2. In Fig. 1 the primaries of two similar transformers are connected in parallel, and the secondaries in opposition, the source of direct current being inserted as shown. In Fig. 2 the primaries are in series, and the secondaries in opposition as before. The inductance



FIGS. 1 AND 2.—ALTERNATIVE ARRANGEMENT OF TRANSFORMERS.

of the second arrangement is double that of the first, and by use of both arrangements a wide range of inductances may be obtained. In the absence of a specially designed choking coil, it is thus necessary to use two transformers for single-phase working. For testing a three-phase alternator at least three transformers are necessary.—Lond. *Electrician*, Dec. 25; Lond. *Elec. Eng'ing*, Dec. 24.

Starting Induction Motor.—A note on a British patent (892) of Crompton & Company; J. C. Macfarlane and H. Burge, for a double-rotor induction motor. In order to obtain a good starting torque with induction motors, it is necessary to have a high resistance in the rotor at starting, but this must be cut out when the motor is running at full speed, or the efficiency will be low. According to this invention two rotors, one with a high and the other with a low resistance, are mounted on the same shaft, and provision is made to move the low resistance rotor into the stator field automatically as the speed increases. Either a screw thread of fast pitch on the hub and spindle or an arrangement of weights acting centrifugally can be used for this purpose.—Lond. *Elec. Eng'ing*, Dec. 24.

Single-phase Commutator Motor.—R. Goldschmidt.—A continuation of his illustrated discussion of the theory of the repulsion motor. After having dealt with the Elihu Thomson type he now takes up the Latour-Winter-Eichberg type, and discusses the armature winding as an exciting winding; the compensation, e.m.fs., currents and fluxes in this motor, and its circle diagram.—Lond. *Elec.*, Dec. 18.

Lamps and Lighting.

Quartz-glass Mercury-Vapor Lamp.—An illustrated description of a quartz-glass mercury-vapor lamp shown at the recent exhibition of the Physical Society in London. The lamp consists of three distinct parts—the anode bulb, the cathode bulb and the vapor tube. The anode and cathode bulbs are different both as to size and shape. The sizes are as far as possible proportioned to the amount of heat developed at the respective poles, in order that the loss of heat at each end may be proportional to the heat generated. This is necessary if vapor is to be produced at the same rate at both electrodes, so that it may be possible for the lamp to burn continuously. Since it is never possible to obtain the precise proportionality required between the sizes of the two bulbs, an additional device has been employed to establish automatically a balance between the heat generated and the heat radiated. This device consists in drawing out the cathode bulb into a narrow neck, where it joins the vapor tube. The bulb and part of this neck are filled with mercury. The heat developed at the surface of the mercury is carried away by the mixing of the hot metal with the colder contents of the bulb; the wider the neck and the nearer the surface of the mercury is to the bulb the more rapidly will this transference of heat be effected. If at any instant the heat is carried away too rapidly, the mercury level in the neck will rise, and this will tend to retard the flow of heat to the bulb. By sufficiently contracting the neck and by making the cathode bulb of a suitable size, it has been possible to produce a lamp which burns for any length of time. The better the electrodes are cooled the greater is the current through the door. To produce a cooling effect the bulbs are surrounded by metal bands carrying cooling fins. On a 220-volt supply, with a regulating resistance of about 50 ohms in circuit, the lamp can be made to burn continuously with an e.m.f. between its terminals varying from 25 to 175 volts. At low voltages the arc fills the entire cross-section of the tube, while at higher voltages it becomes more and more constricted and ultimately forms a thread having a thickness of about 5 mm. "The light yielded by this lamp is said to be the greatest ever obtained. Thus, with 304 volts between the terminals and a current of 3.85 amp, about 6420 cp was developed, which corresponds to an expenditure of 0.182 watt per candle-power." In order, however, not to prejudice the life of the lamp it is usual not to run at a higher e.m.f. than 175 volts. Under these conditions it consumes 4 amp and develops a mean spherical candle-power of about 2860 cp, which is equivalent to 0.244 watt per candle-power. It is well known that the mercury lamp is very rich in ultraviolet rays, also that quartz glass is transparent to such rays down to a wave-length of 185 $\mu\mu$. With increase of temperature and pressure in the lamp a greater yield both of ultraviolet and of visual radiation is obtained for the same amount of power consumed. Also at the higher temperature a greater proportion of red rays are produced, thereby reducing to some extent the disadvantageous color of the mercury lamp. This lamp is said to be the richest available source for actinic rays of short wave-length. At the suggestion of L. Arons (the original inventor of the mercury-vapor lamp) a lamp is now made in which a liquid amalgam replaces the mercury, and it was this type which was shown at the exhibition. This lamp yields an extraordinarily rich line spectrum. The amalgam consists of about 59 per cent Hg, 20 per cent Pb, 20 per cent Bi, 0.5 per cent Zn, and 0.5 per cent Cd. At low voltages the amalgam lamp exhibits only the Hg-Cd-Zn spectrum; at about 100 volts the Bi and Pb spectra become visible in the neighborhood of the electrodes; at about 12 volts the whole arc exhibits line spectra, particularly rich in the ultraviolet region, of all the five metals. The electrical qualities of the amalgam lamp are the same as those of the mercury lamp.—Lond. *Elec.*, Dec. 18.

Incandescent Lamps.—J. Findlay.—A paper read before the Rugby Engineering Society. The physical defects most generally encountered in incandescent lamps, and for which the purchaser should look out, are loose caps, spotted filaments and bad vacuum. In buying lamps not only the price of the lamp, but the cost of the energy consumed, must be considered, and against this must be set the amount of light obtained from the lamp during its life. The author emphasizes the importance

Kind of lamp.	Mean spherical cp.	Watts per candle.	Candles per kw.
Common 56-watt, carbon-filament incandescent lamp, rated at 3.5 watts per candle power, 16 horizontal candle-power	13.2	4.24	236
Common 50-watt, carbon-filament incandescent lamp, rated at 3.1 watts per candle-power, 16 horizontal candle-power	13.2	3.78	264
Three-glower, 264-watt Nernst lamp	81.0	3.26	307
"Gem" 125-watt, graphitized carbon-filament lamp of 50 horizontal candle-power	40.7	3.07	326
40-watt tantalum lamp, rated at 20 horizontal candle-power	14.5	2.75	328
Direct-current, 5.1-amp enclosed arc on 110-volt circuit, 1.5-in. carbons	213.0	2.63	380
Alternating-current, enclosed 5.7-amp arc, taking 388 watts on 110-volt circuit, 5-in. carbons	152.0	2.55	392
60-watt, 110-volt tungsten-filament lamp, burning at 1.25 watts per horizontal candle	37.0	1.62	617

of lamp tests. Even in the case of large private concerns, where energy is generated very cheaply, it is short-sighted policy to employ the cheap lamp. For the candle-power drops so greatly during the first 50 or 100 hours' burning that the total light emitted from a 16-cp lamp of this class is often no more than would be obtained from a properly-rated 8-cp lamp. A good many of the foregoing remarks may be applied with equal force to the tungsten lamp. This lamp is often overrated, a specific consumption of 1.1 watts per candle-power being too low for lamps used on the ordinary circuits, though it might be correct under ideal conditions, say, where the voltage was never more than 1 per cent above the normal. There is reason to believe that the life of a tungsten lamp burning at 1.25 watts per

candle is four times as long as it would be if burned at 1 watt per candle-power. This difference in specific consumption will be caused by a difference of 10 per cent in voltage, and will be accompanied by a rise of 40 per cent in candle-power and 5.5 per cent in current. The figures shown in the table are of various incandescent lamps at present in use.—Lond. *Elec.*, Dec. 25.

Regulation of Arc Lamps.—J. TEICHMÜLLER.—The conclusion of his long illustrated article. The author considers in detail the phenomena of the regulation of arc lamps, especially with lamps of inclined electrodes side by side, and discusses the effect of magnetic fields in the neighborhood of the arc. He contradicts the ordinary explanation of the regulating effect of a magnet, according to which the arc while burning comes nearer the magnetic field and is repelled. The author endeavors to give another explanation of the effect of a magnet field on regulation. He finally describes a method and apparatus for testing the quality of arc-lamp electrodes and the quality of the regulating magnetism of arc lamps.—*Elec. Zeit.*, Dec. 24.

Metallic-Filament Lamps.—B. DUSCHNITZ.—A continuation of his long illustrated serial on recent advances in the manufacture of metallic-filament lamps, based chiefly on patent specifications. In the present instalment the author deals with the latest methods of suspending the tantalum wire in the tantalum lamp of the Siemens & Halske Company, and with methods of suspending the tungsten wire in the tungsten lamps by the German Welsbach Company and the Wolfram Lampen Company.—*Elek. Anz.*, Dec. 13.

Generation, Transmission and Distribution.

British Refuse Destructor Plant.—An illustrated description of the generating station at St. Albans, which is a steam generating station, exclusively dependent on refuse for fuel. The destructor plant consists of two units of three cells each. Each unit is capable of burning from 25 tons to 30 tons of refuse per day of 18 hours. A guarantee was given by the makers of the destructor plant that for each pound of refuse burned 1.69 lb. of water from and at 212 deg. Fahr. would be evaporated at a pressure of 200 lb. per square inch, and at a temperature of 507 deg. Fahr. There are two engines, each of which drives two 75-kw. direct-current generators. They generate energy at 230 volts, one on either side of the 460-volt, three-wire supply network. Factories having a 115-volt system are also supplied with energy. In order to obtain a 115-volt supply, the generator armatures are fitted with two slip-rings connected to opposite points in the winding, and these are connected with compensators through double-pole switches mounted on the machine frames. A tapping is taken out from the neutral point of each compensator, so that the e.m.f between either terminal and the tapping is 115 volts if the total pressure across the machine in question is 230 volts. Connections from the tappings of the two compensators and from the common and outer terminals of the generators thus constitute a five-wire system, from which the energy for the factory can be given.—Lond. *Elec. Eng'ing*, Dec. 24.

Traction.

Electric Automobiles.—E. SIEG.—The first part of an illustrated paper read before the Berlin Electrical Society. For a speed of 15 miles per hour on a level road he says that a specific capacity of the storage battery of about 30 watt-hours per kilogram of total weight is required. German automobile companies use lead accumulators giving 30 watt-hours per kilogram and having 90 per cent amp-hour efficiency and from 75 per cent to 80 per cent watt-hour efficiency. He thinks that the Edison nickel-iron accumulator is much less suitable for automobiles, because it gives only 24 watt-hours per kilogram, 1.2 volts per cell, instead of the 2 volts of the lead cell, and 50 per cent watt-hour efficiency. The Edison plates, however, can withstand about 600 discharges against 150 of the lead cell, but this does not mean less maintenance cost, since the renewal of the plates, though less often, is very much more expensive. The author then discusses the most suitable type of motor for electric automobiles and emphasizes that it should be a series motor. Recent attempts to use a shunt motor are thought to be a mistake. The motors may be either high-speed machines connected to the wheels by gearing or low-speed machines directly coupled to the wheels. The latter system has the following disadvantages: A car equipped with a low-speed motor when running up a grade will be greatly reduced in speed without using less current; on heavier grades the current will increase to an extraordinary degree and the car will only creep. When running at half speed (half normal voltage) the energy consumption per ton-kilometer will be at least one-third higher than for cars with high-speed motors. Moreover, cars with low-speed motors require much more time to run up to full speed and the braking action is very slight, especially at low speeds. Speed regulation is obtained by series-parallel control of the two motors and by variation of the magnetic field of the motors. By increasing the magnetic field a low speed is obtained and at the same time a strong torque for running up a grade. By weakening the field high speeds on level roads are obtained. The division of the battery into two parts for series-parallel connection is not advantageous, since it leads to an unequal use of the cells and results in their earlier destruction.—*Elek. Zeit.*, Dec. 24.

Voltage Drop in Return Circuit of Single-phase Railways—P. DAWSON.—A continuation of his long illustrated serial. In the present instalment the author considers mathematically the pressure drop due to induction in the return circuit of an alternating-current supply of electricity, and gives examples for a trolley wire and a conductor rail.—Lond. *Elec.*, Dec. 25.

Storage-battery Railway Cars.—A fully illustrated description of the accumulator railway cars of the Prussian State Railways, which have already been noticed in the Digest.—Lond. *Elec.*, Dec. 25.

Installations, Systems and Appliances.

British Central Station.—An abstract of last year's financial report of the Bolton municipal electricity works. The number of kw-hours sold exceeds the figure for the previous year by no less than 32 per cent, being 10,791,105 as compared with 8,152,052. This is, to a considerable extent, due to the great development of the motor load, which accounted for 5,080,639 of the total number of units. The traction load takes 4,110,085 units. The private lighting load is, however, by no means insignificant, since it accounted for 1,594,408 units. In spite of an increase of the cost of coal, the total costs, including all capital charges and depreciation, have been reduced by 0.1 cent per kw-hour sold, and now stand at the low figure of 2.24 cents. The latter figure is made up as follows: Generating cost per kw-hour sold, 0.94 cent; distribution cost, 0.06 cent; management cost, 0.06 cent; rents, rates and taxes, 0.08 cent; interest, sinking fund and depreciation, 1.10 cents; total, 2.24 cents.—Lond. *Elec.*, Dec. 25.

Wind Power for Isolated Plant.—J. BOHM.—An illustrated description of an electric installation making use of wind power on a gentleman's farm near Hamburg. Formerly gasolene engines were used as prime movers. There are 400 incandescent lamps and five motors, having a total of 24.8 hp. Electric energy is also used for heating and cooking. The total connections amount to 40 kw. Formerly two gasolene engines of 12 hp and 20 hp were used, driving 110-volt, direct-current generators giving 65 amp and 100 amp respectively, together with a storage battery of 60 cells with a rating of 495 amp-hours for a maximum discharge of 165 amp during three hours. The yearly consumption of gasolene was 10,000 kg at a cost of $525. In 1907 a wind turbine was installed in which the generation of energy began with a speed of wind of from 3 m to 4 m per second. The turbine was rated at 6 hp for wind of from 4 m to 5 m per second, at 14 hp for wind of from 6 m to 7 m, and 20 hp for wind of 8 m. In reality the turbine has a higher output, since it gives 30 hp with a wind speed of 8 m per second. The generator, which is equipped with interpoles, is designed for 80 amp at 110 volts and 1350 r.p.m. for a wind speed of from 6 m to 7 m per second. The connections are shown in Fig. 3. The circuit-breaker, marked "automat I" in the illustration, breaks the connections between

the generator and the battery as soon as the wind speed decreases to such an extent that the voltage at the terminals of the generator would be less than the battery voltage. This circuit breaker consists of a two-core electromagnet *PP* with a main-current winding *a* and a shunt winding *c*. A permanent magnet *m* is placed between the poles, so as to be able to revolve around an axle. This magnet carries a lever *H*, the end of which has two copper arms reaching into two mercury cups. If the generator voltage tends to become smaller than the battery voltage, the current through the shunt winding *c* acts on the magnet *m* in such a way that the two copper arms are removed out of the mercury cups so that the connection between the generator and the battery is broken. When the wind increases the voltage at the terminals of the generator rises to the value of the battery voltage; the current in the winding *c* is then zero. If the generator voltage increases still further, the current in *c* changes its direction and the magnet *m* assumes the position shown in the figure so that connection is now made between the two mercury cups. The battery is then charged by the generator. The apparatus is designed so that this connection is made when the generator e.m.f. is five volts more than the battery voltage. As soon as current exists in the main winding *a*, the current in *c* is practically zero and *H* is held in the position shown in the figure. When the circuit in *a* decreases the circuit is broken and *c* comes again into operation. A second circuit-breaker, marked "automat II," prevents any overload of the generator due to a sudden strong

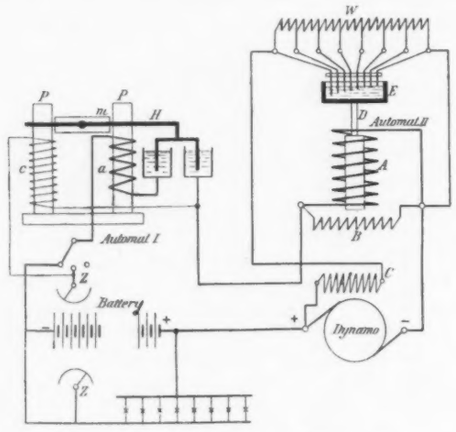


FIG. 3.—DIAGRAM OF CONNECTIONS.

wind. By means of this device portions of the resistor *W* are inserted in the exciting circuit *C* of the dynamo. This apparatus consists of a main current solenoid *A*, the core *D* of which holds a mercury cup *E*. By raising or lowering this cup more or less, a greater or smaller number of the portions of the resistor *W* are immersed in the mercury. It has been found that for 90 days in succession the wind power was sufficient without any necessity of using the gasolene-driven generator held in reserve. The total first cost of the installation, including wind-turbine, generators, battery, the reserve gasolene-generator, switchboard and instruments, was $8,175. The operating cost per year, including interest and amortization, is $1,136. Formerly, when the wind power had not been utilized, the first cost of installation, with two gasolene-generators and a battery, was less; namely, $5,150, but the yearly cost, including interest and amortization, was about 50 per cent higher; namely, $1,690.—*Elek. Zeit.*, Dec. 24.

Switchboard.—G. Wolff.—An illustrated description of a new switchboard design of the Felten & Guilleaume-Lahmeyer Company. The board is built in sections, each of which is removable by means of a little car running on rails. The chief features are that all work done on the switchboard is carried out on the front side, and that by special devices any danger to the attendants has been removed. The construction is said to be especially useful for high-tension switchboards in industrial works.—*Elek. Zeit.*, Dec. 24.

Electrophysics and Magnetism.

Standard of Radioactivity.—The Council of the Roentgen Society has decided to act upon the advice of the committee appointed in 1906 to consider the possibility of preparing a standard for the measurement of radioactivity. This committee recommend that: "The gamma-ray ionization from one milligram of pure radium be regarded as a standard, and called a unit of radioactivity." The Council has deputed Mr. C. E. S. Phillips to prepare a set of three substandards of $RaBr_2$, and these are now maturing. Owing to the co-operation of Prof. E. Rutherford, comparison will be made with a specimen of the purest $RaBr_2$ at the Victoria University, Manchester. The quantity of radium in other specimens will be, by comparison with the substandards, capable of accurate measurement. It is, therefore, anticipated that by this means the exact description of medical, physical, or other work with radium will be facilitated, and that the possibility of fraud in the sale of expensive radium preparations will be eliminated.—Lond. *Elec.*, Dec. 25.

Heusler's Magnetic Alloy.—J. G. Gray.—A paper in which the author describes a series of experiments carried out to investigate: (1) The magnetic properties of the Heusler magnetic alloy (consisting of copper, manganese and aluminum) at temperatures lying between 0 deg. C. and 400 deg. C—about the critical temperature of the material; (2) the alteration in magnetic properties brought about by heating and cooling the material; (3) the magnetic properties of the alloy at low temperatures in the quenched condition.—Lond. *Elec.*, Dec. 25.

Spark Gaps.—R. A. Houstun.—An illustrated note on the electric resistance of spark gaps. The author describes the effect of changing the material of the electrode on the resistance of the spark gap for eight different metals, the other conditions being always the same. Zinc, aluminum, cadmium, tin, copper, iron, brass and nickel were tested. Cleaning of the surface has an effect on zinc, but no definite effect on the others.—Lond. *Elec.*, Dec. 25.

Flash-Over Voltages.—J. Lustgarten.—An illustrated article in which the author discusses "the nature and properties of the gaseous ion by means of which the mechanism of the brush, spark and arc discharges can be satisfactorily explained."—Lond. *Elec.*, Dec. 18.

Electrochemistry and Batteries.

Electric Laboratory Furnace.—An illustrated description of several laboratory resistance furnaces shown at the recent exhibition of the British Physical Society. In one of them the resistor consists of very thin platinum ribbon wound on a porcelain tube. In small sizes the furnace can be used up to 1400 deg. C. In another furnace nickel is used as resistor, wound on a tube of silica. This furnace may be used to a temperature of about 1000 deg. C.—Lond. *Elec.*, Dec. 25.

Units, Measurements and Instruments.

Resistance Thermometer.—An illustrated note on the Harris resistance thermometer, shown at the recent exhibition of the British Physical Society. Its feature is that there is no necessity of balancing a galvanometer to zero in order to get a reading. The instrument depends for its action upon the principle of the two-coil ohmmeter, but one of the coils is wound differentially. One of the differential windings (*X* in Fig. 4) is shunted with a platinum thermometer, the other winding *S* being shunted with a resistor *s*, which is made variable so as to balance the thermometer at certain fixed temperatures. The control coil *D* of the ohmmeter system is also shunted with a resistor *d*, the resistance of which is determined by the degree of sensitiveness required, and may be made variable with *s*. These shunted windings are connected in series, and the circuit is completed through a battery and switch. By using a differential winding, the currents in which are respectively due to the resistances of the thermometer and *s*, in conjunction with a control coil, in which the current is proportional to a selected difference unit *d*, the advantage is gained of making the indicator read on both sides of what would be the zero point in a non-differentially wound ohmmeter, thus increasing the possible length of the scale from under 90 deg. of arc to something approach-

ing 180 deg. Moreover, as the deflection is proportional to the ratio of the difference in the currents in the differential windings to the current in the control coil, the sensitiveness for a given variation in the temperature of the thermometer may be made as great as is required by giving a suitable value to *d*, and is limited only by practical considerations.—Lond. *Elec.*, Dec. 25.

Resistance Box.—A note on Campbell's constant-inductance resistor box and constant-inductance rheostats, shown at the recent exhibition of the (Brit.) Phys. Soc'y. The arrangement of the

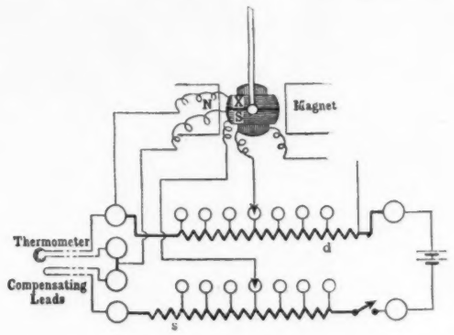


FIG. 4.—DEFLECTIONAL RESISTANCE THERMOMETER INDICATOR.

winding of these is such that the resistance can be altered without varying the inductance. This is secured by means of duplicate windings in copper and manganin, so arranged that as manganin resistance is cut out, or in, an equivalent number of turns of copper are cut in or out. The coils of the resistor box are immersed in oil.—Lond. *Elec.*, Dec. 25.

Rheostat.—A note on a fine adjustment rheostat shown at the recent exhibition of the (British) Physical Society. It comprises a slate cylinder carrying resistor wire wound in a spiral groove cut in its edge. This drum is carried on a spindle screwed for a few turns to the same pitch as the spiral in which the wire is wound. Pillars mounted on the slate base carry a casting tapped to take the screwed portion of the drum spindle, the other end of which is carried by a bearing in the slate base. A contact slides along one of the pillars supporting the top casting. The coarse adjustment is obtained by sliding the contact up and down the pillar, the fine adjustment being obtained by rotating the drum.—Lond. *Elec.*, Dec. 25.

Telegraphy, Telephony and Signals.

Continuous Oscillations by Rotating Disks.—R. RÜDENBERG.—An investigation of the action on which the new arrangement of rotating disks depends, which is used by Marconi as a generator for continuous, or, rather, closely adjacent, trains of oscillations used at his high-power stations. The author first points out that the arc is able to produce oscillations of very high frequency only when it is supplied with some means for quickly getting rid of the heat liberated in it. Simon and Poulsen obtain this result by conduction, using metal electrodes, which can, in addition, be water-cooled. Marconi prefers the convection method, employing rotating disks as electrodes, at the periphery of which the current passes in the form of an arc. During operation the whole disk acquires a certain temperature which is practically the same at all parts and an increase of temperature takes place only at the edge where the arc passes. The lower the rise of temperature the higher the efficiency of the arrangement. The author calculates this rise of temperature as functions of the different factors. Even with a slow speed of rotation a very noticeable cooling effect is obtained. Copper is the best material to use.—Lond. *Elec.*, Dec. 25.

Wireless Telegraphy.—H. POINCARÉ.—Continuations of his serial of lectures on the theory of wireless telegraphy, dealing with the electromagnetic field around the vertical transmitting wire, the propagation of waves and their way of getting around obstacles, and the phenomena in the receiving antenna.—*La Lumière Elec.*, Dec. 5, 12 and 19.

Miscellaneous.

High-resistance Materials.—A note on a British patent (4657) of C. Ruzicka for high-resistance materials, the chief feature of which is the employment of metallic compounds or salts as fluxing or welding agents. The resisting composition may consist of 60 parts of coal tar, 12 parts of quartz, 24 parts of potassium feldspar, and 10 parts of potassium tetraborate. A molded rod of this mixture, 1 sq. cm in section and 10 cm in length, after being heated to a temperature of above 1000 C., has a resistance of about 10,000 ohms. Instead of coal-tar, resin may be the chief component. In the specification 9762 resistance materials of much lower specific resistance and suitable for use in heating and cooking apparatus are described. One of these consists of 20 parts of iron oxide, 33 parts of nickel oxide, 26 parts of calcium feldspar and 18 parts of bauxite. A material of still lower specific resistance is obtained if iron and nickel nitrates are substituted for the iron and nickel oxides respectively in the above composition. The mixtures are molded and baked at a high temperature as in the first case. In a further specification, 9763, a resistance material containing carbonized petroleum residue, potassium feldspar and quartz; and another consisting mainly of silicium carbide and potassium feldspar, are described.—Lond. *Elec. Eng'ing*, Dec. 24.

Insulating Material.—A note on a British patent (27,060) of J. Johnson, describing a hard material suitable for base-blocks for switches and other purposes. It consists of about 40 per cent sulphur and 40 per cent of either lampblack or mica, or a mixture of the two. Various earths or coloring materials may be added.—Lond. *Elec. Eng'ing*, Dec. 24.

NEW APPARATUS AND APPLIANCES

New Tungsten Reflector and Fixtures.

The use of tungsten lamps presents a new problem in electric lighting—that of securing a proper diffusion of the intense rays which are developed. One of the means being offered to secure better results with such lamps is a new type of glass reflector known as "Opalux" tungsten reflectors, which, it is claimed, so diffuse all the light given out that a maximum of illumination is secured at a minimum cost for current. Other features of the new reflector are its artistic appearance, mechanical stability, ease of cleaning and minimum liability to become soiled.

In the new "Opalux" reflector the diffusing surface is on the reflecting side. The reflector is a glass which is perceptibly translucent and it has a surface entirely different from that produced by the ordinary etching, sand-blasting or enameling processes. While the "glaze" of the glass is entirely removed, the surface is of such a high degree of smoothness that it can be cleaned as readily as ordinary glass and at the same time does not give sufficient direct reflection to produce perceptible glare. The reflected light from this glass is of a pearly luster, slightly opalescent. The transmitted light is stated to show a variation of soft color tints and to illuminate the ceiling with a warm glow, entirely free from sharp contrasts in intensity. The ornamental detail has been designed to present no sharp corners or deep grooves, but an even surface very readily cleaned, and being made by pressing, the reflector has ample mechanical strength. Since in this glass the reflection is largely diffused, the contour or general shape of the reflector is varied to several forms without materially changing the distribution curve.

To obviate the mistakes so frequently made of considering

the globes and shades an entirely distinct and separable part of a fixture, special fixtures have been designed for use with "Opalux" reflectors which insure that harmony and proportion of line in both fixture and glassware which are a most im-

FIG. 1.—OPALUX REFLECTOR.

portant feature in the decorative treatment of lighting fixtures. These fixtures are simple in design, and are intended to anticipate a demand for high-grade tungsten fixtures which will be artistic, attractive and durable, and at the same time harmonize

FIG. 2.—OPALUX REFLECTOR.

with any style of decoration used in buildings where tungsten lamps will be in service.

The accompanying illustrations show the flat and bowl type of "Opalux" reflectors, and one of the ceiling fixtures. The

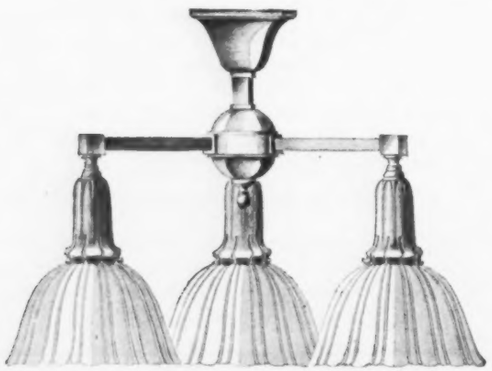


FIG. 3.—OPALUX TUNGSTEN EQUIPMENT.

reflectors and fixtures described are being marketed by the Pettingell-Andrews Company, of Boston, and the Central Electric Company, of Chicago.

Triangular Bit for Boring Square Holes.

The problem of boring square holes or holes of other shapes than round, has long attracted inventors and is, moveover, of considerable practical interest in view of the wide use of such holes for counter-sinking and for keys, wrenches, spanners, hand-wheels and similar articles. The present methods of making square holes, outside of punching and casting, such as first boring round holes and then working them up by hand or by means of a slotter or shaper, are laborious, expensive and much slower than the making of the round hole itself, which practically limits their use. The machine shown herewith, however, is said to bore square holes with the same facility and with nearly the same speed that the ordinary twist or flat drill will bore round holes in the same material. At the same time the tool, while not altogether as simple as the flat drill, is not complicated nor expensive, and is easily made or

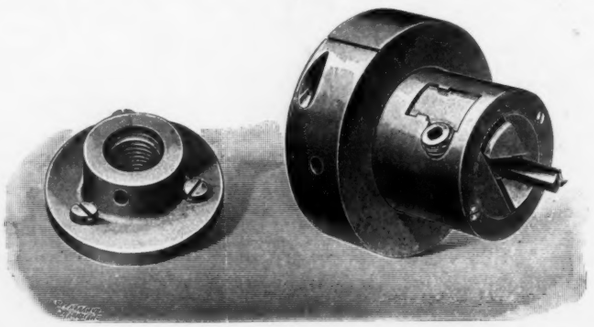


FIG. 1.—TRIANGULAR BIT.

ground in the average machine shop. The only appliance needed for the use of this special tool upon such machines as lathes, drill presses and milling machines is a special chuck. The chuck is really a device of making the three-cornered boring tool or bit travel about in such a way as to strike out a square hole in the work. It consists of a driving part which is screwed onto the spindle of the machine, a guiding part which either rides upon the first part, or else is secured permanently to the frame of the machine, and a third part, or socket, into which the shank of the drill is screwed. This third part is caused to rotate by the first part, but has a slight freedom of motion in relation thereto, being guided as to its exact movements by the matrix or frame in the stationary part. Where square holes are to be drilled the shank of the tool is three-cornered, the sides of the shank being formed by segments of circles, struck from opposite corners as centers, the radius of these circles being the same and equal to one of the sides of the square hole which is to be drilled. The guide in the stationary part of the chuck is adjusted to the size of the hole to be drilled, so that the sides of the square opening are just equal to the radius by which the circles used for striking out the sides of the shank are formed. When one of the sides of the shank is either rolling or sliding upon one of the sides of the

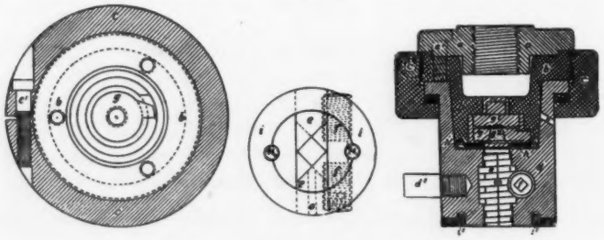


FIG. 2.—DETAILS OF TRIANGULAR BIT.

square guide, the opposite corner of the shank will be moving in a straight line in contact with the opposite side of the guide. The corresponding corner of the head of the tool would at the same time strike out a straight line in the work. This motion takes place on all four sides of the guide, except for a little space at each corner, the result being that the hole is square except for a slight rounding at the corners. If it is desired to bore out a complete square with sharp corners, a special tool is employed, having a shank considerably larger than the head of the tool, one corner of the shank being rounded instead of angular. The exact form of this round-cornered shank has been worked out empirically and a complete set of templets made for the different sizes of tools apt to be required in actual practice. The tools for both the round-cornered and sharp-cornered squares can be ground by means of a special attachment to the ordinary grinding machine. This device is being introduced in this country by the Radical Angular Drill Company, New York City.

Motor-Driven Box-Car Loader.

The box-car loader shown in the accompanying illustrations has been developed for loading coal in box-cars, where it will be safe from theft, and in order to comply with the requirements relating to the shipment of coal to the West, which necessitate the use of box cars which are employed for transporting grain from the West. The loader illustrated has been installed at the Silver Creek colliery of the Philadelphia & Reading Coal & Iron Company at New Philadelphia, Pa., for handling anthracite coal. It is driven by a 75-hp series-wound motor receiving energy through two trolley wires, the track not being used for an electrical circuit.

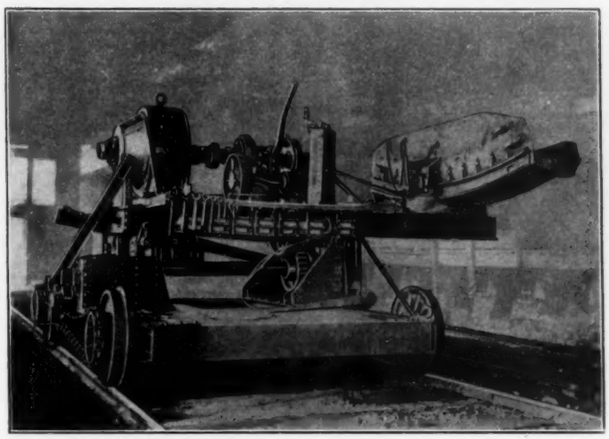


FIG. 1.—GENERAL VIEW OF BOX-CAR LOADER.

Coal is supplied from overhead bins to a hopper, from which it is distributed alternately to the ends of the car, the hopper being entirely inside the car when at work. The hopper rocks up and down and at the same time moves back and forth from one end of the car to the other. As it passes from one end to the other it receives coal from the chute and carries it to the end of the car; here it is emptied by the movement of a scraper which passes through the hopper, pushing the coal ahead of it. The motion of the hopper is reversed by reversing the motor, but a mechanical reversing device is used on the scraper. The motor is a 220-volt direct-current machine built by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

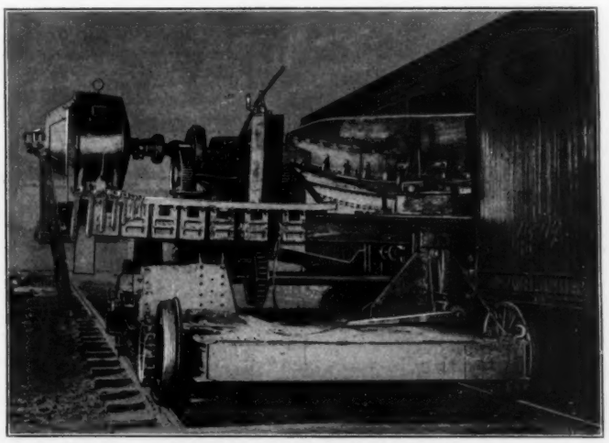
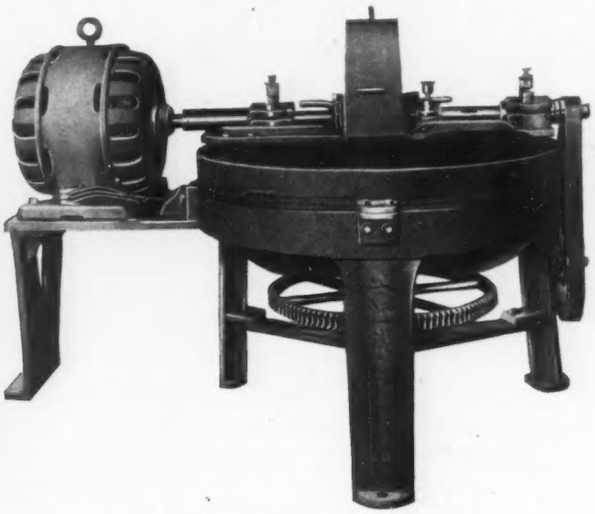


FIG. 2.—BOX-CAR LOADER ENTERING CAR.

Largest Meat Cutter in the World.

A meat cutter, said to be the largest ever made, has been recently changed from steam to direct-connected motor drive, because of the delays formerly experienced in getting up steam, which materially reduced the output of the grinder. The meat cutter in question, here shown, was built by the John E. Smith's Sons Company, of Buffalo, and is installed at the sausage factory of Jacob Moschel, Buffalo. It has a 43-in. bowl and six knives, each of which has a cutting edge 18 in. long. The power is supplied by a Westinghouse three-phase alternating-current motor of 20-hp capacity, which runs at a speed of 1420 r.p.m. Electrical energy is obtained from the circuits of the Niagara Falls Power Company.

Mr. Moschel now cuts approximately 25,000 lb. of sausage a day. This cutter can handle the entire output if desired, as it has a capacity of 250 lb. in five minutes. One of the reasons for the change from steam to motor drive was also the saving in the expense for attendance of an engineer, as well as the greater convenience when motor driven. The attendant of the meat cutter does all the work of looking after the machinery that formerly required the entire time of another man, for with the electric motor "there really is no work to do," as stated by one of the men connected with this installation.



ELECTRICALLY DRIVEN MEAT CHOPPER.

Portable Electric Breast Drill and Grinder.

The main feature of the portable electric breast drill, made by the Willey Machine Company, of Jeffersonville, Ind., and shown herewith, is the simplicity of its construction. Only two gears are used and these are cut from bar steel. The drill spindle has two long bearings, with removable bushings of phosphor bronze, in place of the single, short bearing often met with in drills of this type. Owing to the low speed of the motor, the wear on the commutator, bushings, gears and bearings is comparatively slight. By removing two nuts the entire machine can be taken apart for inspection of the enclosed mechanism. All the electrical connections are attached to the main casing of the machine, and are not disturbed when it is taken apart for any purpose. A snap switch is located on the

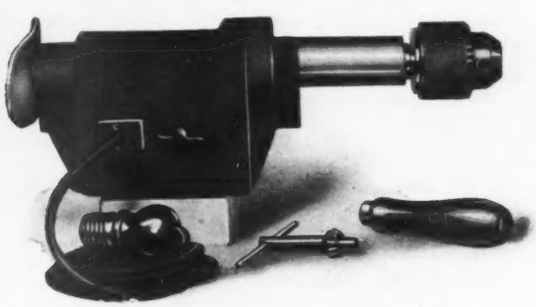


FIG. 1.—BREAST DRILL AND GRINDER.

side of the frame, convenient for starting and stopping the drill. Special attention has been given to ventilation, insuring cool running and high efficiency of the motor. A system of air ducts has been provided in the armature for this purpose similar to those found in larger electrical apparatus. The tool is made in four sizes, the largest of these having two speeds. The motors are wound for either direct or alternating current and

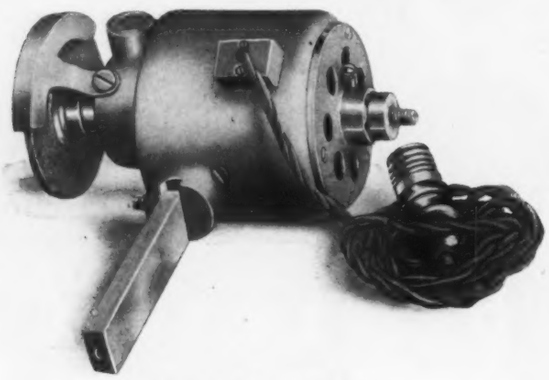


FIG. 2.—LATHE GRINDER.

for any voltage up to 250. The side handle can be quickly attached or removed as required by the work in hand.

The grinder shown in Fig. 2 is intended for lathes having compound rests. In applying the device, the compound rest is simply swiveled to the desired angle and the grinder clamped to the tool post, after which the center may be ground. The centers of lathes having plain rests can be ground by taking a succession of cuts the width of the wheel and grinding to gage. All of the connections, etc., of the motor are enclosed and the motor is wound for voltages up to 250. The grinder is made in two sizes.

Electrical Trade Society of New York.

The Electrical Trade Society of New York has issued in pamphlet form a report of its thirteenth annual meeting, held at the Electrical Club, New York, Dec. 8, 1908. President R. B. Corey presided at the meeting, at which the following officers for the ensuing year were elected: President, Mr. A. L. Miller, John A. Roebling's Sons Company; vice-president, Mr. P. M. Haight, Sprague Electric Company; treasurer, Mr. W. H. Roberts, W. R. Ostrander Company; secretary, Mr. Franz Neilson, 80 Wall Street, New York. The secretary's report shows that the number of members on Nov. 30, 1908, was 95; the total number of accounts handled during the year were 2939, involving $301,507, of which 2517, involving $241,306, were settled. The total number of names now recorded on the delinquent list of the society is 4750. The pamphlet includes the address of President Corey and an abstract of the statement of the secretary.

Silundum.

One of the latest products of the electric furnace and one which possesses interesting electrical properties is silundum, or silicified carbon. For the production of this material electric furnaces, the same as those used for the manufacture of carborundum, are employed. The pieces of carbon of various shapes are introduced into a mixture of sand and carbon—that is, acted upon by a granular core of coke as conductor for the electric current. Instead of sand and carbon, amorphous carborundum can be used enriched with sand to provide the necessary silicon for the carbon pieces to be converted into silundum.

Silundum being another form of silicon carbide has generally the same properties. It is very hard; it resists temperatures up to about 1600 deg. C. when heated in the air and does not oxidize. It resists the attack of acids when cold and is a conductor of electricity and its resistance is several times that of carbon. The hardness of silundum is variable and depends on the zone around the core of the furnace in which it is produced. Material from the amorphous zone is less hard than that obtained in the crystalline zone. It may be assumed that the hardness depends on the temperature in which the material is produced. The hardness may also depend on the amount of silicon taken up by the carbon. It seems that some pieces contain more or less silicon than others, but no analysis was made to ascertain this. At about 1700 deg. C. the silicon leaves the carbon and combines with the oxygen of the air.

Silundum cannot be melted and it behaves in this respect like carbon. The electric resistance of silundum is variable and depends on the kind of carbon and its hardness. Silundum made from porous carbons has a higher resistance than that made of hard carbon. The resistance depends also on the modification of the material. If produced in the amorphous zone the resistance is generally higher than in the crystalline zone.

The first use for which the material found application was for electric cooking and heating purposes. The electric heating industries for domestic as well as for industrial purposes demand for a large number of appliances a higher temperature than can be obtained by ordinary resistance wires. Platinum, of course, can be used, but this material is very expensive, especially so when thick wires or ribbons are used. Silundum replaces platinum for this purpose and is much cheaper.

Electric cooking and heating industries have developed in the last five years enormously and will continue to do so as electric energy becomes cheaper. The result is that there will be a demand for a large number of electric ranges that can be used for any cooking utensil, just like a gas range. The electric range demands, however, a concentration of electric energy to be converted into heat that cannot be obtained at present with any system without overheating the resistances or without increasing the weight of the heating plate, with the result that the time for preparing meals becomes too long if compared with heating by gas or coal. Silundum withstands very high heat, does not oxidize and can be used with the necessary high temperature needed for the purpose. Ranges are produced that have the glowing heat of a coal fire and they are used exactly as those heated by coal.

For industrial purposes there is a large field for heating apparatus for melting metals—brass, aluminum, lead, tin, etc.—and for electric ovens of high temperatures for laboratories. For these purposes the material fills a long felt want. Platinum and platinum-iridium have been used to a great extent for laboratory ovens, but the apparatus is very expensive and can be repaired only at great cost. Silundum can be used with just as high temperature as platinum and the first cost of the apparatus, as well as the repairs, are considerably lower.

For heating purposes the silundum rods can be used single in lengths up to 800 mm—depending, of course, on the diameter—as solid round, flat or square rods or tubes, or it may be made into grids, mounted in a frame and provided with contact wires.

Silundum withstands the attack of acids and experiments are now being made with a view to using it for electric bleaching purposes instead of platinum-iridium, carbon or graphite. In order to prevent the oxidation of carbon electrodes used for the manufacture of ferro-silicon it has been proposed to cover these electrodes with a layer of silundum.

Silundum can be nickel-plated or covered with a layer of platinum. It is a very refractory material and does not melt. It is, however, attacked when at high temperatures by molten metals, but this should not prevent its use as fireproof material. It is not necessary to silicify pieces to be used for fireproof purposes entirely, but only to a certain depth and according to the use for which they are destined. Carbon bricks, or any shaped pieces, can be covered with a layer of silundum at small cost. It is thus possible to obtain a material that for many purposes will be far superior to any fireproof material known so far. The material is marketed by the Roessler & Hassbacher Chemical Company, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The situation in trade is one of preparation and anticipation. The usual post-holiday quiet is very much in evidence in all lines, both wholesale and retail. There are active preparations going on for good business that is anticipated within the next few weeks or within the next few months. Wholesalers and manufacturers expect a demand that will keep them busy. They are thoroughly prepared to take care of any demand that arises; in fact, there has been plenty of time for preparation because actual business for the last three months of 1908 was not more than 65 per cent of normal. Some business has been developed within the past week by the reduction sales in which almost all retailers indulge immediately after the holidays. It is always the policy of the retail merchants to clear out their shelves of all surplus stock that can be got rid of by forced sales at reduced prices. These are going on all over the country, and while they do not signify any increase in real business, they do turn into money certain quantities of surplus stock. This leaves the retailer in better condition for the coming year's business. He has his shelves fairly well cleared, and he has money to pay for new purchases. The severe cold wave which spread over the western portion of the country had its advantages and its disadvantages. It certainly, to some extent, stimulated the sale of goods for winter wear which had been retarded by prolonged warm weather. On the other hand, it, in a measure, retarded business because it came in the shape of a sudden freeze after a considerable spell of wet weather. This closed up many country roads and necessarily kept purchasers out of the market. In jobbing and wholesale lines invoicing has been concluded and salesmen are being started out with samples for new business. It is too early yet to make any reports as to the success with which these salesmen are meeting. The fact that they are on the road and that the wholesalers are pushing for trade must, of course, mean an increase in business. Whether they do all that is expected or do not they will certainly gather many orders. The iron and steel markets are quite dull, and prices are practically unchanged. But few sales of steel rails have been made, and as yet none of the important roads have come into the market since the beginning of the year. It is known, of course, that the railroads must buy so that this stagnation is merely temporary. There are not many orders being placed for structural material, but a number of inquiries are being made, and it is said that specifications are being drawn up for many extensive projects. The building industry is only active in small construction. This makes the lumber market good, helps the cement and brick market, but does not do very much toward aiding structural steel. The whole condition of trade is one of expectancy and optimism. Every one is looking for heavy business in the near future, but it is not here now. Business failures for the week which ended Jan. 7, as reported by *Bradstreet's*, were 329, as against 299 the week previous, 435 in the same week of 1908, 283 in 1907, 286 in 1906 and 295 in 1905.

THE COPPER MARKET.

The copper market is strong in price, firm in tone and there has been a slight advance during the past week. If the statistics of supply and demand are considered there is no reason for this feeling. The production of copper goes on more actively than ever, while it is not admitted by the selling agencies the stocks in this country must be very large, the stocks in Europe are known to be enormous and the demand from actual consumers is extremely light. The only explainable reason for the strength in tone is the fact that the powers which are under the market and are determined to uphold prices are encouraged to believe that the hardest part of their task is over. According to the preliminary estimate of the Government, the production of copper in 1909 is not likely to be more than 50,000,000 lb. greater than in 1908, and is not likely to grow materially in the next few years. The consumption, on the other hand, in the coming year and in future years, will be vastly greater than in 1908. It is argued from these facts that having been able to sustain level prices during the past very lean year, there should be no trouble in the better years to come. The producers also point with confidence to the vast number of electrical projects that are simply waiting for normal business conditions to return before being pushed to completion, and to the fact that hand-to-mouth buying has for so long a time been the policy of all industrials that stocks in consumers' hands must in consequence be running low. The fact remains, however, that the United States is producing, including imports, about 110,000,000 lb. per month, and is consuming, including exports, not more than 90,000,000 lb. per month. This steady and enormous accumulation may be considered a guarantee for a long time to come that there will be no skyrocketing in copper prices. The fact that all current statistics of production and of sales have been unreliable has at times created an uncertainty in the market which the promoters of the uniform price level are anxious to avoid. With this purpose in view, the recent meeting of copper interests was held and the formulation of plans begun for maintaining a statistical bureau. It is said that the committee having these plans in hand is about ready to report, but no announcement has been made as yet. It is expected that the producers will—when accurate statistics are at hand—be able to exercise even greater control over the market than at present. Imports continue to be active, and since the first of the year have been more than 1500 tons. Exports for the month up to and including Jan. 11 were 6221 tons.

Prices quoted on the Metal Exchange Jan. 11 were:

Lake	14 3/8	@	14 1/2
Electrolytic	14 1/8	@	14 1/4
Castings	14	@	14 1/8

The London market was as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	62	15	0	62	12	6
Standard copper, futures	63	10	0	63	7	6
Market	Weak.			Easy.		
Sales of spot				1,600 tons		
Sales of futures				400 tons		

Extreme fluctuations for this year:

	Highest.			Lowest.		
Lake copper, spot	14 1/2			12 3/8		
Electrolytic copper, spot	14 3/8			12 1/4		
Casting copper, spot	14 1/4			12 1/2		
London, spot	£64	17	6	£56	5	0
London, futures	65	15	0	56	17	0
London, best selected	68	10	0	60	0	0

PLATINUM AND THE TARIFF.—Since the Ways and Means Committee of Congress has been considering the new tariff bill there have been all kinds of petitions received asking for increases of duties or the imposition of duty where none has heretofore existed. The question of a duty upon platinum utensils is a case in point. Under the present law these are admitted free, and those in favor of a continuance of this status say American manufacturers of platinum wares have been able at all times to compete with the Europeans, American platinum ware being sold abroad to a considerable extent. The Ways and Means Committee of Congress, however, has been petitioned by J. Bishop & Company, of Malvern, Pa., to put a duty on platinum apparatus and on platinum wire. In this communication the petitioner says: "We feel that this industry has been sadly neglected in the way of tariff protection, and there is no doubt but what the domestic requirements can be taken care of by American manufacturers. It is conceded that the products of our works are the finest made either in this country or abroad, and consequently the matter of quality cannot be raised as an objection by importing houses. We are confident that the business could be greatly enlarged and American labor given an additional field of employment if a duty is placed on manufactured platinum." The communication then suggests that 25 or 30 per cent ad valorem would be satisfactory. The argument has also been made to the committee that the imposition of a duty on manufactured platinum would result in the establishment in this country of a number of plants. It is believed that the foreigners who now sell in this market would be compelled to do their manufacturing on this side and the industry would be stimulated to that extent.

Mr. Cyrus Osborne Baker, one of the largest importers and manufacturers of platinum in the country, had this to say about a tariff: "I cannot see the necessity of a tariff on platinum wares. I shall take no steps to secure one and the only result of a tariff would be to increase the price to the consumer. The talk of a tariff to protect American labor seems to me foolish. While, of course, labor in Europe is much cheaper than in this country, the labor cost of platinum apparatus is proportionately so small that it cuts little figure. With crude platinum selling at $24 per ounce—the present price, which is likely to go higher—the cost of the material is so many times greater than the cost of labor that a 25 per cent tax in order to protect labor would be a handicap. Our methods of manufacture in this country are, I think, superior to those in Europe, and I have no fear about being able to compete. We want to encourage the use of platinum and the cheaper the finished goods can be made the more this will be done. In this connection it is only necessary to call attention to some of our principal platinum industries, such as artificial teeth and incandescent lamps. At the present time, as I understand it, we furnish about 70 or 80 per cent of the artificial teeth used in the world. In this work 80 per cent of the cost for material is for the platinum used, so you can see the effect on the industry. A duty of 25 per cent on the platinum would increase the cost of the teeth 20 per cent and would practically destroy a foreign trade that now runs well up into the millions. The same is true with regard to electric lamps. At the present time, as I understand it, the value of the platinum in every carbon incandescent lamp is about one-tenth of the actual cost of the lamp. A 25 per cent increase in the cost of the platinum would mean a slight increase in the cost of the lamp. I do hope, however, that Congress will remove some of the inequalities in the platinum schedule that now exist. Platinum is placed on the free list and all the other metals in the platinum group, except rhodium and ruthenium. By some oversight these were not enumerated when the present law was drawn and they now pay 10 per cent ad valorem under the 'unenumerated' clause. Then there are the alloys of metals in this group which are not mentioned and while they are admitted free now any collector is likely to rule that they should pay and seriously interfere with business. We want the matter definitely settled."

STEAM TURBINE BUSINESS.—The Westinghouse Machine Company reports good progress during recent months in the steam turbine business despite the general depression. Out of the most important business covering some 20 machines ranging in size up to 10,000 hp, there is the usual activity in electrical, power and traction work, and a fair demand from various industries, including phosphate, cement and rubber mills, steel car works and oil refineries. Inquiry for exhaust-steam turbines is active, and several equipments have been contracted for. The most important orders are as follows: Metropolitan Street Railway, Kansas City, 15,000 kw; Narragansett Electric Light Company, Providence, R. I., 7,000 kw; Capitol Traction Company, Washington, D. C., 3000 kw; B. F. Goodrich, Akron, Ohio, 1500 kw; Tampa (Fla.) Electric Company, 1500 kw; Colorado Springs Electric Company, 1000 kw; Pressed Steel Car Company, McKees Rocks, Pa., 2000 kw. In addition to the above, there are equipments of 1000 kw and under for the Portland Cement Company, Denver; Coronet Phosphate Company, Plant City, Fla.; Bronx Gas & Electric Company, Westchester, N. Y.; Black Hills Traction Company, Deadwood, S. D.; Jacksonville Oil Mill Company, Jacksonville, Ala.; Fall Mountain Electric Light & Power Company; Bellows Falls Electric Company, Bellows Falls, Vt.; Tide Water Oil Company, Bayonne, N. J.; city of Logansport, Ind., and Bristol (Tenn.) Gas & Electric Company.

GENERAL ELECTRIC GETS LARGE MOTOR ORDER.—Among the recent good orders taken by the General Electric Company is one for 90 two-motor car equipments to be installed on the new steel cars being constructed for the Hudson & Manhattan Railroad Company by the Pressed Steel Car Company. These motors will be the standard 150-hp type with General Electric M. controls. Taken as a whole, the General Electric Company reports that the volume of its business varies little from that of the last three months of 1908. The plants are being operated on a basis of about 60 per cent where the larger apparatus is manufactured, and about 80 per cent for the smaller concerns. A special investigation of conditions, made by the company, leads to the belief that it will not be long before re-equipment will be begun on a generous scale. This applies especially to power houses throughout the country. In this connection the company especially anticipates future developments based on steam turbines, which, it is claimed, have established records for economy and efficiency all over the country. The General Electric also regards the tungsten lamp as a field where excellent business may be expected, and the company is preparing to be especially active in this field.

DEMAND FOR APPARATUS.—The new orders at the shops of the Westinghouse Electric & Manufacturing Company turned in recently are chiefly with the railway department. This includes one for the equipment of 200 cars for the Third Avenue Railway Company, of New York City, with a large amount of power-house apparatus, representing an expenditure approximating $500,000, as noted Jan. 2. Another contract of importance taken is an order for 55 mining locomotives from the Clinchfield Coal & Coke Company, of Clinchfield, W. Va., to be used for the transportation of coal in that company's mines. The East Pittsburg shops are also busy with the construction of a quantity of electric railway apparatus for the Spokane & Inland Railway Company, of Spokane, Wash., to be used in extension of that company's single-phase system. Two 4000-hp water-wheel generators are being furnished to the Southern Power Company, of Charlotte, N. C., along with a lot of auxiliary power-house machinery for the extension of that company's large power transmission system in the cotton-growing district of North Carolina.

PAPER MILL CONTRACT.—An important contract for electrical machinery has just been closed by the Oxford Paper Company, of Rumford Falls, Me., with the Western Electric Company. The machinery purchased includes five motor-generator sets, consisting of five 500-hp, 2,300-volt induction motors, driving 330-kw, 230-volt, direct-current generators, with motor-driven exciters and a 13-panel switchboard. Electrical energy is to be taken from the line of the Rumford Falls Power Company, which is increasing its plant for that purpose. This electrical machinery is to be used in a large new plant which the Oxford Paper Company is now building to manufacture for its own use, bleach liquor and caustic soda by a new electrolytic process invented by Jasper Whiting, of Boston, and developed under his direction during the past three years. The Whiting process employs mercury as an agent, and produces only chemically-pure materials. It is said to be exceptionally economical as regards the use of power and to require only a minimum amount of labor in its operation.

NEW HYDRO-ELECTRIC DEVELOPMENTS.—Mr. H. von Schon, consulting engineer, Wayne County Bank Building, Detroit, Mich., is preparing plans for a 6000-kw hydro-electric plant on the Sturgeon River, Michigan, including a dam 100 ft. high, the power to be transmitted to the copper region near Houghton. The proposals for material include wooden stave and steel plate pipe, hydraulic and electric generating equipment and transmission line fixtures. The same office is also engaged on plans for a hydro-electric plant at Cuyahoga Falls, Ohio for an Eastern syndicate. A fall 350 ft. will be utilized, and the storm run-off is to be stored. This will be the highest head development yet undertaken east of the Rocky Mountains excepting a plant planned by the same engineer at Eugenia, Ont., which has had a head of 400 ft. Mr. von Schon has also been retained by a syndicate to report on the hydro-electric development of Marble Falls, Tex., and the necessary surveys are now being made under his directions.

THE AMERICAN LOCOMOTIVE COMPANY has purchased a plot of 130 acres of land at Gary, Ind., from the Gary Land Company, a subsidiary company of the United States Steel Corporation, and plans are being drawn for a new plant which officers of the locomotive company say will be the most complete and best equipped locomotive works in the world. The land purchased is twice the extent of that occupied by the largest of its present plants, and when fully occupied will give employment to from 12,000 to 15,000 workmen.

TO BUILD BIG TUNGSTEN LAMP PLANT.—The Economy Electric Company, in conjunction with the Peerless Electric Company and the Hydro Electric Company of Warren, Ohio, will shortly begin the construction of a big tungsten lamp factory at Warren. It is proposed to make the factory one of the largest and most complete in the country.

STORAGE BATTERY OUTPUT.—In common with other branches of electrical manufacturing, storage batteries felt the effect of the depression last year, and this was noted in a recent issue of *Electrical World*. Mr. Charles Blizard, vice-president of the Electric Storage Battery Company, in commenting on this situation, considers the statements made as too pessimistic, and in an interesting letter says: "As a matter of fact, our business for 1908 was a considerably larger percentage of our business for 1907 than was reached by most of the other large electrical manufacturing companies. While there was a decrease in large contract work, it was compensated for by a very satisfactory increase in the use of storage batteries for miscellaneous classes of service."

GENERAL ELECTRIC COMPANY'S COPPER MINE.—During the year 1908 the General Electric Company secured from its Bully Hill mine, in California, about 3,500,000 lb. of copper, or about 10 per cent of the total requirements of the company for the year. The mine did not begin to produce until April, and after that time the output was about 400,000 lb. per month. The company hopes to double this amount in the future.

KEYSTONE TELEPHONE COMPANY.—The officials of the Keystone Telephone Company of Philadelphia announce that they will soon have direct trunk lines between Philadelphia and Pittsburg in operation. There is already long distance connection between these cities, but there are not enough circuits to make the service always available.

Financial Intelligence.

THE WEEK IN WALL STREET.

The effect of the decision of the United States Supreme Court in the Consolidated Gas case has been felt in the stock market all week. The hour before the decision was made public gas stock was selling at 165¼; within two days it went as low as 123. This was a decline of 42 points, and while there has been some reaction, the prevailing quotations are still below 130. The effect which this great decline had upon the market was not entirely of a sympathetic nature, although such a break in one issue of necessity affects the entire list. Much of the disturbance in other stocks was due to the selling made necessary by speculative holders in order to secure funds to protect their gas investments. Even with this the strength of the market was indicated by the fact that the general decline only averaged from 2 to 5 points on the week. The dealing in stocks for many months past has been almost entirely speculative and has been done largely by the professionals of the Street. The public has not been investing to any extent, and the regular traders who make a business of watching the ticker and buying and selling have been responsible for the bulk of the trading. Such dealers are rarely willing to take a heavy loss caused by a sudden flurry if they can command the means to protect their holdings. There is another feature connected with the Consolidated Gas decision which, while it has had no effect upon the price of the stocks, has caused considerable discussion among the financiers. This is the practical declaration by Judge Peckham that a public service corporation had a right to earn 6 per cent as a fair return upon its entire investment. It is argued, on the one hand, that such a limitation may interfere with the freedom with which money will be subscribed for new public service ventures, and on the other, that the way public service expenditures are capitalized 6 per cent would be an attractive return upon the actual investment. There is little likelihood that any sort of analysis will develop in the gas decision a menace to corporate interests. The refusal to permit the Government to review the decision overruling the $29,000,000 fine imposed upon the Standard Oil Company by Judge Landis has been regarded as a distinct victory for corporations. While there has been considerable disappointment over the tardiness with which commercial and industrial business has recovered toward normal conditions, and while there is a special disappointment over the fact that orders which were anticipated immediately after the first of the year for iron and steel products are not forthcoming, the general opinion of Wall Street is that improvement is at hand and this opinion is especially strengthened by the liberal growth in railroad earnings. The reports for November for many of the principal roads show enormous gains over the reports for November, 1907, and show very substantial gains over the previous months in 1908. More and more rolling stock is being daily employed and the earning capacity of the railroads, owing to the economies in operation, will compare favorably with those of the flush period. The money market is as yet undisturbed, but there is a feeling of uneasiness lest a time will soon come when substantial increase in rates will be necessary. There is great uneasiness in European centers over the political situation, and the Bank of England's rate of discount is sure to be higher. Already there are some shipments of gold engaged, and the threatened withdrawals by the United States Treasury may seriously reduce the surplus of the national banks. The fact that the expenses of the Government are running something like $10,000,000 a month in excess of its receipts causes a disquieting feeling among conservative financiers. So far this feeling has done nothing in the direction of curtailing the active investment in bonds. Every issue that is offered is rapidly taken up. Money rates Jan. 11 were 1¾ and 2 per cent for call loans, and 3 per cent for 90-day paper. The quotations in the table are those of the close, Jan. 11.

NEW YORK.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
All.-Ch.	15⅛	15	1,200	Int.-Met., pfd.	46¾	43¼	92,800
All.-Ch., pfd.	49⅜	47¾	2,550	Mackay Cos.	76	75*	1,100
Amal. Cop.	82⅞	81½	151,195	Mackay Cos., pfd.	70	69½	1,710
Am. D. T.	35*	35*	———	Manhattan Elev.	152	150	2,370
Am. Loc.	56½	55⅜	9,250	Met. St. Ry.	40	34¼	440
Am. Loc., pfd.	114*	111	350	N.Y. & N.J.Tel.	112*	113	50
Am. Tel. & Cbl.	78*	78*	———	Steel, com.	52⅞	51¾	431,910
Am. T. & T.	127¼	126¾	9,992	Steel, pfd.	112⅞	112⅞	15,496
B. R. T.	69½	68⅜	177,095	W. U. T.	68½	68¼*	2,500
Gen. Elec.	156	155½	6,400	West'h., com.	85	84	3,100
Int.-Met., com.	17¾	15⅜	64,710	West'h., pfd.	120	120*	200

PHILADELPHIA.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
Am. Rys.	45	45½	———	Phila. Elec.	11¾	11¾	———
Elec. Co. of A.	11⅜*	11⅜*	———	Phila. R. T.	25½	26	———
Elec. Stor. B'ty.	47	44	———	Phila. Traction.	90½*	91¼	———
E. S. B'ty, pfd.	49*	49*	———	Union Traction.	51½	52⅛	———

CHICAGO.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
Chi. City Ry.	180*	180*	———	Chi. Tel. Co.	127	128	———
Chi. Rys., Ser. 1.	116*	116*	———	Met. El., com.	17	17*	———
Chi. Rys., Sec. 2.	45½*	45½*	———	Nat'nal Carbon.	85*	84¼	———
Com. Edison	108	108	———	Nat. Carb., pfd.	112	112*	———
Chi. Subway	28¾	27⅛	———				

BOSTON.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
Am. Tel. & Tel.	127½	126¾	———	Mex. Tel.	2½*	2½*	———
Cum. Tel.	126	126*	———	Mex. Tel., pfd.	5½*	5½*	———
Edison El. Ill.	247	247¾	———	N. E. Tel.	126¾*	131	———
Gen. Elec.	157	156	———	W. Tel. & Tel.	8	8*	———
Mass. Elec. Ry.	12	11⅝	———	W. T. & T., pfd.	81	81*	———
Mass. E. R., pfd.	60	59	———				

*Last price quoted.
Shares sold are for week Jan. 4 to Jan. 9.

DIVIDENDS.

American Light & Traction Company, New York, N. Y., common, quarterly, 2 per cent, payable Feb. 1.

American Light & Traction Company, New York, N. Y., preferred, quarterly, 1½ per cent, payable Feb. 1.

Bell Telephone Company of Canada, preferred, quarterly, 2 per cent, payable Jan. 15.

Bell Telephone Company of Philadelphia, preferred, quarterly, 1½ per cent, payable Jan. 15.

Central & South America Telegraph Company, New York, N. Y., preferred, 1½ per cent, payable Jan. 8.

Cincinnati, Newport & Covington Light & Traction Company, Covington, Ky., common, quarterly, ⅛ of 1 per cent, payable Jan. 15.

Cincinnati, Newport & Covington Light & Traction Company, Covington, Ky., preferred, quarterly, 1⅛ per cent, payable Jan. 15.

General Electric Company, Schenectady, N. Y., common, quarterly, 2 per cent, payable Jan. 15.

Lowell Electric Light Corporation, Boston, Mass., quarterly, $2 per share, payable Jan. 15.

Mexican Light & Power Company, Mexico, Mex., common, quarterly, 1½ per cent, payable Jan. 15.

Mexican Telegraph Company, New York, N. Y., quarterly, 2½ per cent, payable Jan. 15.

Minneapolis (Minn.) General Electric Company, common, quarterly, 2 per cent, payable Feb. 1.

Minneapolis (Minn.) General Electric Company, preferred, quarterly, 3 per cent, payable Feb. 1.

Nebraska Telephone Company, Omaha, Neb., common, quarterly, 1¼ per cent, payable Jan. 10.

Philadelphia Company, Pittsburgh, Pa., common, quarterly, 1½ per cent, payable Feb. 1.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—Mr. George C. Smith, an executive officer and director in many auxiliary Westinghouse companies, has been appointed by the new board of directors of the Westinghouse Electric & Manufacturing Company as its special representative in connection with its interests in a number of electric railway and power companies whose securities are held as investments. Among the companies are the Lackawanna & Wyoming Valley Rapid Transit Company and subsidiary companies; Niagara, Lockport & Ontario Power Company; Electric Power Securities Company, Niagara Falls; Grand Rapids, Grand Haven & Muskegon Railway; Atlanta Water & Electric Power Company. Mr. Smith's headquarters will be in the City Investing Building, New York.

RUTLAND RAILWAY, LIGHT & POWER COMPANY.—William A. Read & Company, Boston and New York; Redmond & Company, Philadelphia and New York, and Warner, Tucker & Company, Boston, offer for subscription at 95 and interest the unsold portion of $1,500,000 first mortgage 5 per cent sinking fund gold bonds of the Rutland Railway, Light & Power Company, Rutland, Vt., dated March 1, 1906, and due March 1, 1946. The bonds are redeemable at 110 and interest as a whole or in amounts of not less than $50,000 on any interest date after March 1, 1916. Mr. Robert L. Warner has been elected a director of the company to represent the bankers who offer the bonds for subscription.

NEW YORK STATE RAILWAYS.—The Guaranty Trust Company, New York, has issued a circular to the holders of the 5 per cent preferred stock of the Rochester Railway quoting a letter from Mr. Horace E. Andrews, president of the Rochester Railway, informing holders that the consolidation of the various electric railways in New York State of which control has been acquired by the New York Central & Hudson River Railroad and the Central Railway Syndicate is being perfected with the approval of the Public Service Commission of the Second District of New York. The name of the new company will be the New York State Railways.

CALIFORNIA GAS & ELECTRIC CORPORATION.—It has been decided to extend until Feb. 1, 1909, the terms of the agreement dated Jan. 20, 1908, which provides for the exchange of the general mortgage and collateral trust 5 per cent bonds of the California Gas & Electric Corporation, San Francisco, Cal., for the new issue of unifying and refunding mortgage 5 per cent 30-year bonds of the company, with a bonus of an amount of common stock of the Pacific Gas & Electric Corporation equal to 25 per cent of the par value of the bonds exchanged.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—The stockholders of the American Telephone & Telegraph Company, New York, N. Y., at a special meeting on Jan. 7, voted to increase the capital stock of the company from $250,000,000 to $300,000,000, and filed notice of the increase with the Secretary of State of New York at Albany on Jan. 8. The new stock and the $69,413,000 of the unissued stock of the company will be applied for the conversion of the $150,000,000 of 4 per cent convertible bonds of the company into stock. The bonds by their terms are convertible after March 1, 1909.

COMMONWEALTH EDISON COMPANY.—The Commonwealth Edison Company, Chicago, Ill., is offering until Jan. 18 to exchange its first mortgage bonds for $1,483,000 of 6 per cent bonds of the Chicago Edison Company maturing July 1, 1909, and $5,000,000 of 5 per cent bonds of the Chicago Edison Company maturing Sept. 1, 1909. The Commonwealth Edison Company first mortgage bonds are to be taken in the exchange at 102 and interest, while premiums of $9 and $6 are to be allowed, respectively, to holders of the 6 per cent and the 5 per cent bonds.

CHICAGO CONSOLIDATED TRACTION COMPANY.—The bondholders' committee of the Chicago (Ill.) Consolidated Traction Company has extended from Dec. 31, 1908, to Feb. 1, 1909, the time for the deposit of the following underlying bonds of the north division of the Chicago Consolidated Traction Company: Chicago Electric Transit Company; North Chicago Electric Railway; North Side Electric Street Railway; Chicago North Shore Street Railway, and Evanston Electric Railway. The Harris Trust & Savings Bank, Chicago, is depositary.

CHICAGO RAILWAYS.—As there are still outstanding $18,500 of the underlying bonds of subsidiary roads of the Chicago Union Traction Company, out of a total of $25,412,500, the Chicago Railways Company has authorized the Harris Trust & Savings Bank, Chicago, depositary, to accept deposits up to Feb. 1, 1909, so that the holders of the securities still outstanding may participate in the reorganization plan.

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY.—The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., has sold $2,475,000 of 4½ per cent general mortgage bonds held in the treasury to E. H. Rollins & Sons, Boston, and Drexel & Company, Philadelphia. Including the $2,475,000 of bonds just sold, there are now outstanding $5,200,000 of the 4½ per cent issue.

COMPANIA DE TRAMVIAS DE MEXICO, S. A.—Mr. F. S. Pearson, president of the Compania de Tramvias de Mexico, Mexico City, Mex., is reported to be negotiating for the purchase of the Chihuahua & Pacific Railroad, and the property of the Sierra Madre Land & Lumber Company, in behalf of the Canadian syndicate which controls the Compania de Tramvias de Mexico.

UNITED POWER & TRANSPORTATION COMPANY.—Mr. Charles Henry Jones and Mr. John W. Ellard have been appointed receivers of the Southwestern Street Railway by Judge Howland, in the United States Circuit Court, Philadelphia. The United Power & Transportation Company, Philadelphia, Pa., owns 7995 shares of the 8000 shares of the Southwestern Street Railway.

CICERO & PROVISO STREET RAILWAY.—The protective committee of bondholders of the Cicero & Proviso Street Railway, Chicago, Ill., has extended until Jan. 20 the time for depositing bonds with the Illinois Trust & Savings Bank, Chicago, depository. Of the outstanding issue of $1,948,000 more than $1,500,000 have been deposited.

MERCHANTS' HEAT & LIGHT COMPANY.—The stockholders of the Merchants' Heat & Light Company, Indianapolis, Ind., have authorized an increase of $500,000 in the common stock. The company proposes to erect an additional plant in the western part of Indianapolis.

WEST END STREET RAILWAY.—The committee of stockholders of the West End Street Railway, Boston, Mass., which was appointed to investigate the proposed merger with the Boston Elevated Railway has received the indorsement of holders of 131,209 shares of stock.

MILLIKEN BROTHERS.—Judge Holt, in the United States District Court, on application of Mr. William N. Cromwell, has signed an order extending the receivership of Milliken Brothers, New York, N. Y., to March 1, 1909.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Bangor Railway & Electric Company, Bangor, Me.:					
Year ended June 30, 1908	$528,282	$288,616*	$239,666	$131,850	$107,816
Year ended June 30, 1907	370,278	258,879	211,399	93,614	117,785
Demerara Electric Company:					
November, 1908	10,671	6,051	4,620	.....	.....
November, 1907	10,238	5,672	4,566	.....	.....
Kansas City (Mo.) Railway & Light Company:					
November, 1908	543,514	300,966	242,548	153,899	88,649
November, 1907	518,424	276,030	242,394	151,099	91,295
Mexican Telegraph Company, New York, N. Y.:					
Quarter ended Dec. 31, 1908	197,500	48,500	149,000	.....	.....
Quarter ended Dec. 31, 1907	212,000	43,000	169,000	.....	.....
St. Joseph (Mo.) Railway, Light, Heat & Power Company:					
December, 1908	83,259	36,848	46,411	.....	.....
December, 1907	74,172	36,170	38,002	.....	.....
San Joaquin Light & Power Company, Los Angeles, Cal.:					
Year ended Nov. 30, 1908	362,529	116,721	245,808	103,400	142,408
Year ended Nov. 30, 1907	301,752	100,821	200,931	61,728	139,203
West Jersey & Seashore Railroad, Camden, N. J.:					
November, 1908	307,353	282,132	25,221	17,112	8,109
November, 1907	371,702	297,846	73,856	17,112	56,742

*Including taxes.

GENERAL NEWS

Construction News.

CHICO, CAL.—It is reported that the Sierra Electric Power Company will soon commence operations in Chico. The company's plant will be located on Digger Creek, 15 miles from the foot of Mount Lasson, 50 miles north of Chico.

OAKLAND, CAL.—The Seventh Street Improvement Club has awarded the contract for furnishing and erecting 150 electroliers on Seventh Street to the United Iron Works, of Oakland, for $16,000.

OAKLAND, CAL.—The California Electrical Generating Company has issued a deed of trust to the Central Trust Company, of New York, giving as security all the holdings of the company. The company is capitalized at $7,500,000 and owns valuable rights in the Sierra, which it proposes to develop. It will generate and transmit electricity from the mountains to the bay cities. Guy C. Earl is president of the company and W. H. Spaulding is secretary.

OAKLAND, CAL.—The Big Bend power plant of the Great Western Power Company was put into operation Dec. 18. Only 15,000 hp is being generated at present; the amount will be increased immediately, and during the month of January it is expected that 50,000 hp will be produced. The transmission lines have been completed to Oakland. The company has expended so far $12,000,000. The output of the Big Bend plant is to be increased to 100,000 hp. It is said that the company next year will begin the construction of a large dam at Big Meadows, where another power plant will be located. When the system is completed the company will have a total output of 450,000 hp. H. P. Wilson is secretary.

OROVILLE, CAL.—The Oroville Water, Light & Power Company is constructing a transmission line from Oroville to the Big Blue Lead Mine near Bangor.

PASADENA, CAL.—C. W. Koiner, manager of the municipal electric light plant, in his report submitted to the City Council recommends the purchase of the distributing system and equipment of the Edison Electric Company at a fair valuation. The Council is considering plans to increase the output of the municipal electric plant to furnish electricity for commercial purposes, which will require an expenditure of about $150,000, as follows: For installing a 750-kw generating unit in the power station at a cost of $52,000; pole line equipment, extending the system to all parts of the city, making 1600 additional service connections, to cost about $100,000.

SAN ANDREAS, CAL.—Frank Z. Towle has filed notice of appropriation of 30,000 cu. in. of water of South Fork of Mokelumne River and 20,000 cu. in. of water in the Middle Fork of Mokelumne River.

GREELEY, COL.—The contract for furnishing electricity for lighting the streets and public buildings of Greeley has been awarded to the Home Electric Light & Power Company. The company agrees to furnish 7.5-amp arc lamps at the rate of $84 per lamp per year, with an all night and every night service, and five cents per kw-hour for electricity for the city library. Electricity for lighting the City Hall and other service is furnished free of charge. The company will at once install transformers, distributing system, lamps, etc. Robert McF. Doble, Majestic Building, Denver, Col., is consulting engineer.

HARTFORD, CONN.—The Rocky River Power Company will apply to the State Legislature for a franchise to develop water power in the Housatonic River in Litchfield County. The company proposes to erect dams across the river in the towns of Cornwall and Sharon to generate electricity to operate manufacturing plants in both towns.

MANCHESTER, CONN.—The Glastonbury Power Company has applied to the Legislature for amendments to its charter allowing it to lease the property and franchise to the Manchester Light & Power Company with power to do all things necessary to supply electricity and gas within the territory of the Manchester company.

MERIDEN, CONN.—Cornelius J. Danaher, of Meriden, has applied to the State Legislature for a charter to construct an electric railway from Meriden to Berlin, Conn., with a branch to the Berlin station; also from the Meriden-Mildale electric railway through Kensington to a connection with the Berlin-New Britain railway at Berlin Junction; also from a point on the latter route to connect with the Arch Street line in New Britain, Conn.

PUTNAM, CONN.—The Putnam Light & Power Company is installing a 150-kw generator, which will be operated by water power at the French River Textile Company in Mechanicsville. R. E. Thurston is manager.

WILMINGTON, DEL.—The Street and Sewer Commissioners have extended the contracts for lighting the city with gas and electricity until March 1. The present contracts expired Jan. 1.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 30 for installing one electric freight elevator at the Navy Yard, Mare Island, Cal. Plans and specifications can be obtained on application to the bureau or to the commandant of the Navy Yard, Mare Island. R. C. Hollyday is chief of bureau.

WASHINGTON, D. C.—Bids will be received until Jan. 19 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various naval stations and navy yards the following supplies: Boston, Mass.: Schedule 788—Changing the frequency changer in the central power station to motor generator. Norfolk, Va.: Schedule 789—Furnishing and erecting a switchboard.

CEDARTOWN, GA.—Arrangements are being made by the Water and Light Department to install a duplicate generating unit in the municipal electric plant in the spring. A day service will also be established. W. T. Hardy is superintendent.

COVINGTON, GA.—Plans are being considered by D. W. Wilson, of the Oak Hill section, to install an electric light plant in connection with his mill, to furnish electricity for lamps in that district.

EAST POINT, GA.—Bids will be received by the Mayor and City Council until Jan. 19 for furnishing material and erecting at East Point, Ga., electric light plant, water works and sewerage system, as follows: One 150-hp boiler, 72 x 18 stack; two 750,000 gal. in 24 hours compound duplex pumps; one boiler feed pump; one 125-hp direct-connected four-valve engine; one air compressor and receiver; 75 hydrants; 700 tons cast iron pipe and specials, etc., and construction of pumping station; one 100-kw alternating-current generator, direct connected; 25 arc lamps and regulator, switchboards and feeder panels, including all instruments, and the erection of transmission lines. Specifications can be secured by applying to E. H. Davis, engineer, Griffin, Ga. J. C. McKenzie is mayor.

ELBERTON, GA.—Plans are being considered for extensions and improvements to the municipal electric light plant, which will include the installation of a larger alternator, a 50-hp motor and turbine pump. G. W. Hubbard is superintendent.

GAINESVILLE, GA.—We are informed that surveys have been completed by the Atlanta, Norcross & Gainesville Electric Railway Company for the first section of its proposed electric railway between Atlanta and Norcross. From Norcross the railway is to be extended through Buford and Flowery Branch to Gainesville. H. D. Jaquish, of Gainesville, Ga., is general manager and E. Philbrick, of Baldwin, is chief engineer.

HONOLULU, HAWAII.—Plans have been completed for the proposed power plant to be erected in Nuuanu Valley which will furnish electricity for lighting the city and to operate the pumps in connection with the water works system. Electricity will be transmitted from the plant in Nuuanu to the Beretania Street pumping plant, a distance of six miles. It is proposed to erect two smaller power houses.

IDAHO FALLS, IDAHO.—A. V. Scott, president of the Idaho Power & Transportation Company, writes that the company is planning to double the output of its present plant.

LAPWAI, IDAHO.—J. W. Fenderson, of Lapwai, contemplates installing an electric light plant in this place.

SODA SPRINGS, IDAHO.—The Soda Springs Electric Company is planning to extend its transmission lines to Alexandria and Davisville in the spring. A. L. Cook is superintendent.

ALTAMONT, ILL.—The Effingham County Telephone Company has increased its capital stock from $8,000 to $10,000.

AURORA, ILL.—The City Council has authorized the lighting committee to purchase incandescent lamps for the new electric light system.

CASEYVILLE, ILL.—The County Commissioners have granted a franchise to the East St. Louis & Caseyville Electric Railway Company to construct an electric railway through East Lansdowne Heights to Caseyville.

CHICAGO, ILL.—The City Council has granted the Illinois Tunnel Company a two-year extension of its franchise without any requirement that it extend its service.

CHICAGO, ILL.—In a report submitted by the city's special subway bureau it is proposed to build a subway extending for more than three miles in a straight line as the first to be undertaken in connection with the underground traction system, the cost of which is estimated at $50,000,000. The plans as outlined provide for four tracks capable of handling 240 surface cars and 350 elevated cars each hour.

CHICAGO, ILL.—Announcement has been made that the Atchison, Topeka & Santa Fe Railroad Company will operate its entire main line from Chicago to the Pacific Coast by telephone, instead of telegraph. Contracts have been let for the installation of the system between Kansas City and Emporia, Kan. The cost of the entire work is estimated at $2,000,000.

CHICAGO, ILL.—Bids will be received at the office of the business manager of the Board of Education, 730 Tribune Building, Dearborn and Madison Streets, Chicago, Ill., until Jan. 20, for the following work: For masonry, sheet metal, composition roofing, structural iron, carpentry, electric work, gas fitting, heat regulation, ventilation, etc., in the Blaine

School gymnasium addition and the Smyth School gymnasium; electric work in the Marshall High School addition; telephones and bells in the Tilton School and Trumbull School. Proposals must be made out on the regular printed forms to be obtained at the office of D. H. Perkins, architect of the board, and T. J. Waters, chief engineer, which may be seen at the office of the architect, 714 Tribune Building.

JOLIET, ILL.—Plans have been prepared by Charles Munroe, general manager of the Economy Light & Power Company, for lighting by electricity the whole business district of Joliet; also the removal of all telegraph, telephone and electric transmission lines from the streets.

MOLINE, ILL.—The People's Power Company has increased its capital stock from $1,000,000 to $2,000,000. It is said that the company proposes to make extensive improvements to its electric and gas systems. F. W. Reimers is general superintendent.

PEKIN, ILL.—The County Board is considering the question of purchasing an electric light plant for the county infirmary. For further information address the superintendent.

PROPHETSTOWN, ILL.—The capital stock of the Prophetstown Mutual Telephone Company has been increased from $6,500 to $10,000.

SORENTO, ILL.—The Sorento Electric Light Company is making arrangements to enlarge its plant in the spring and will be in the market for a 150-hp engine and a generator of from 75 to 100 kw. The plant will be changed from direct to alternating current system. Thomas Scharf is president and manager.

WORDEN, ILL.—The question of issuing $12,000 in bonds to establish a municipal electric light plant in Worden is under consideration.

BLUFFTON, IND.—A petition has been filed with the County Commissioners asking for a special election to vote on a subsidy of $10,000 in aid of the construction of the Bluffton, Berne & Celina Interurban Railway.

BROWNSTOWN, IND.—The Brownstown Water, Light & Traction Company contemplates the construction of an electric railway connecting Seymour, Brownstown, Salem, West Baden and French Lick, a distance of about 70 miles. The company operates an electric light plant and water-works system in Brownstown and expects to extend its transmission lines to Valloma in the near future to supply electricity for lamps. The power station and repair shops will be located in Brownstown. W. B. Holton, of Indianapolis, is president and general manager.

EVANSVILLE, IND.—Mayor Boehme, in his annual message, advocates the construction of a municipal electric light plant. The city's lighting contract with the Evansville Gas & Electric Light Company expires Aug. 11, 1910, and the Council is urged to take up the matter at once and, if possible, secure a municipal plant by the time the present contract expires.

FOWLER, IND.—The Fowler Utilities Company contemplates the installation of a new engine and generator, direct connected, meters, transformers, overhead material, electric drive for deep well pumps, new boiler settings and new switchboard. R. J. Chapman is manager.

FRANKFORT, IND.—The managers of the municipal electric light plant are planning to extend the transmission lines to Mulberry and Kirklin, Ind. W. H. Carter is superintendent.

INDIANAPOLIS, IND.—An appropriation is being asked of the Legislature for the construction and equipment of an electric light plant in connection with the State House.

INDIANAPOLIS, IND.—The Peoples' Light & Heat Company is planning to construct a plant at the coal fields and transmit electricity to Indianapolis, a distance of 75 miles. Paul H. White is secretary.

INDIANAPOLIS, IND.—The Indiana, Ohio & Illinois Railroad Company will commence work on the construction of its proposed electric railway in the near future. The railway will be about 200 miles long, connecting Indianapolis and Chicago, Ill., and intervening points. Thomas P. Kiser, of Indianapolis, Ind., is president and general manager.

INDIANAPOLIS, IND.—The stockholders of the Merchants' Heat & Light Company have voted to increase the capital stock of the company from $150,000 to $500,000 and the bonded indebtedness from $500,000 to $2,000,000, the proceeds to be used to enlarge and extend its plants. The company proposes to erect a new plant in the western part of the business section of the city.

JEFFERSONVILLE, IND.—Bids will be received until Jan. 22 at the general depot, quartermaster department, Jeffersonville,, Ind., for electrical supplies, etc., required for replenishment of stock, as per schedule, which will be furnished on application at this depot.

KENTLAND, IND.—It is reported that the Kentland Light & Ice Company, recently incorporated, will soon ask for proposals for the construction of a combined electric light, water and ice plant. Hugh Hill is president.

NEW ALBANY, IND.—The City Council on Jan. 4 instructed Mayor Best to advertise for bids for lighting the streets of the city and to furnish gas for a period of 10 years from July, 1910, at which time the contract with the United Gas & Electric Company expires.

RILEY, IND.—The Farmers' Independent Telephone Company, recently incorporated, is in the market for material and construction of an exchange and telephone plant in this town and throughout Vigo and Clay Counties. Hartley Brill is president and Henry Haas secretary.

ST. PAUL, IND.—The Town Board will soon ask for bids to furnish material and labor for wiring the town for electric lighting, electricity for which is to be obtained from the Indianapolis & Cincinnati Traction Company.

SHOALS, IND.—A movement is on foot to construct and equip an electric light plant in this city.

TOLESTON, IND.—The Michigan City Gas & Electric Company has applied to the Town Council for a franchise in Toleston. The Ganz Heat, Light & Water Company has also petitioned for a franchise in this town.

VINCENNES, IND.—Arrangements are being made by the Vincennes Electric Company to install a 150-hp Houston, Stanwood & Gamble boiler in its plant. A. J. Heitz is superintendent.

CLINTON, IA.—Work has commenced on the construction of the new power house for the Chicago & Northwestern Railroad Company. The plant will furnish electricity for lamps, heat and power for the bridge, interlocking plants, switches, depot and other buildings.

GREENE, IA.—The Greene Electric Light & Power Company has constructed a dam on the property purchased from the Greene Manufacturing Company and is planning to connect its electric plant with the water power plant this year. The company proposes to erect a new power house, which will be equipped with a water wheel, a 150-kw generator and switchboard. A day service will be established when the plant is completed. R. Miner is secretary.

GRUNDY CENTER, IA.—An election will be held Jan. 20 to vote on the proposition of granting a franchise to the Iowa Construction Company to construct and operate a street railway, electric power plant, gas plant and telegraph system in Grundy Center.

MISSOURI VALLEY, IA.—Plans are being considered by the Missouri Valley Electric Light Company to install a gas plant in the spring. H. E. Anderson is president and manager.

OSCEOLA, IA.—The Osceola Light, Heat & Power Company is planning to install an ice plant in the near future. J. E. Barnard is manager.

LARNED, KAN.—The C. W. Smith Electric & Ice Company contemplates extending its transmission lines to small towns, which will require the erection of about 20 miles of transmission line.

MADISON, KAN.—The Madison Light & Ice Manufacturing Company is planning to install a 150-hp boiler in its plant. F. L. Krueger is president of the company.

LEBANON, KY.—The Lebanon Light, Ice & Power Company is contemplating increasing the output of its plant and overhauling all its lines. R. T. Melton is superintendent.

OWENSVILLE, KY.—The City Council has voted to require the Cumberland Telephone & Telegraph Company to remove all its poles and wires from the streets of this city. It is claimed that the company is operating without a franchise.

THIBODAUX, LA.—The Board of Aldermen is considering the question of remodeling the municipal electric light plant or building a new one.

PEMBROKE, MAINE.—We are informed that the Pennamaquam Power Company is planning to rebuild its plant soon. E. Cushing is engineer.

PORTLAND, MAINE.—The Portland Railroad Company is planning to install a motor generator at the power house of the Cape division, and arrangements have been made with the Consolidated Electric Light Company to furnish electricity to operate the same.

RUMFORD FALLS, MAINE.—The Oxford Paper Company has placed an order with the Western Electric Company for machinery for the manufacture of bleach liquor and caustic soda by a new electrolytic process invented by Jasper Whiting, of Boston, Mass. The equipment includes five motor-generator sets, each consisting of a 500-hp, 2300-volt induction motor direct connected to a 330-kw, 220-volt direct-current generator. Electricity for operating the plant will be furnished by the Rumford Falls Power Company.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 19 to furnish a quantity of naval supplies at the Naval Academy, Annapolis, Md., as follows: Schedule 800—motor generator set. Schedule 804—pipe, dynamo, etc. Applications for proposals should designate the schedule desired by number. Blank proposals will be furnished upon application to the navy pay office, Baltimore, Md., or to the above bureau. E. B. Rogers is paymaster-general, U. S. N.

CAMBRIDGE, MD.—R. B. Fentress, of Baltimore, Md., and associates are making arrangements to install an electric light plant in Cambridge, contracts for the construction of which have already been awarded. It is proposed to incorporate a company under the name of the Cambridge Light & Power Company to operate the plant. The directors for the first year will be R. B. Fentress, W. H. Medford, Phillips L. Goldsborough, Albanus Phillips and John H. Burgess. Cambridge already has an electric lighting system installed by the gas company.

DANVERS, MASS.—The municipal electric light plant is making a good showing, and the income is such as to warrant a recommendation for a reduction in the charges for electricity for lighting purposes. It is said that Superintendent Lynch is to recommend to the town through the commissioners a reduction in the charge for arc lamps from $56 to $50 per year and for incandescent lamps from $15 to $12 per lamp per year; also for electricity to private consumers from 11 cents to 10 cents per kw-hour.

SHELBURNE FALLS, MASS.—The Heath Telephone Company has taken over the system of the Deerfield Valley Telephone Company. The headquarters on Bridge Street will be retained.

SHELBURNE FALLS, MASS.—The machinery in the new power station of the Shelburne Falls Electric Light & Power Company has been placed and will soon be put in operation. The company is planning to establish a 24-hour service in the near future.

TAUNTON, MASS.—The municipal electric light department is making extension to the street lighting system in Whittenton and is installing lamps on Danforth, West Britannia, Pleadwell, Van Buren, Waverly, Bay Streets and Power Avenue.

ANN ARBOR, MICH.—The Eastern Michigan Edison Company has come into possession of water power rights on the Huron River, formerly controlled by Frank J. Cornwell and John Duffy, of Ann Arbor. It is said that the company will furnish electricity in Ann Arbor, Dexter and Chelsea for lamps and motors.

BIG RAPIDS, MICH.—The electric plant of the W. E. Donley Electric Light & Power Company was recently destroyed by fire. The water turbine plant was only slightly damaged. It is said that the plant will be rebuilt at once.

CHASSELL, MICH.—The electric plant of the Worcester Lumber Company has been put in operation and is furnishing electricity for street lighting service. It is expected a residence lighting service will be established. The plant has an output sufficient to supply 1000 incandescent lamps.

CHELSEA, MICH.—Plans are being considered to increase the output of the municipal electric light plant, which will include the installation of a direct-current unit, direct connected, and a water-tube boiler. J. F. Maier is manager.

DETROIT, MICH.—Bids will be received at the office of the Public Lighting Commission, 40 Atwater Street, East Detroit, Mich., until Jan. 18 for the installation of an electrical generating plant in the municipal electric lighting plant in accordance with plans on file in the office of the commission. F. T. Bowler is secretary of the commission.

DETROIT, MICH.—Plans are being prepared by H. von Schon, Detroit, Mich., consulting engineer, for the construction of a hydro-electric plant on the Sturgeon River in the Upper Peninsular. The work will include the construction of a dam, 100 ft. high; wooden and steel plate pipes, hydraulic and electric equipment and transmission line apparatus. The plant will have an output of 6000 kw, which will be distributed in the copper region near Houghton, Mich.

STANDISH, MICH.—The Michigan State Telephone Company has leased all the lines of the Northeastern Telephone Company, which extends into 15 counties, including this county, north of Bay City and east of the M. C. R. R. to the Straits of Mackinac. The system includes over 600 miles of lines, which will be under the management of Superintendent Saunders, of Bay City, Mich.

STURGIS, MICH.—The Board of Public Works is contemplating changing the street lighting system from direct current to alternating current. B. T. Barton is manager.

WALTON, MICH.—The Township Board has granted the Western Michigan Power Company a franchise to erect its transmission lines in this town, for a consideration of $50 per mile. The general offices of the company are at Cadillac, Mich.

WYANDOTTE, MICH.—The Board of Public Works is considering the question of improving the street lighting system. It is proposed to rearrange the circuits and erect heavier wires.

BAUDETTE, MINN.—The managers of the municipal electric light plant are contemplating the installation of a new 75-hp steam engine in the plant next summer. J. A. Gjelhaug is superintendent.

MINNEAPOLIS, MINN.—Mayor J. C. Haynes in his message advocates the construction of a municipal electric light plant.

PARK RAPIDS, MINN.—A franchise has been granted to L. H. Hide to establish an electric lighting system in Park Rapids.

PINE CITY, MINN.—Plans are being considered by the Snake River Power Company to develop water power of Snake River. It is proposed to dam the river about seven miles east of Pine City and erect transmission lines to Hinckley and Rush City. J. M. Allen is interested in the enterprise.

WINONA, MINN.—The Winona Railway & Light Company will obtain electrical energy from the La Crosse Water Power Company after Jan. 15 for operating its system. N. M. Argobriti is general superintendent.

McCOMB, MISS.—The McComb City Electric Light & Power Company is installing a 675-kw generator in its plant. A. H. Jones is general manager.

MERIDEN, MISS.—The Home Telephone Company is planning to extend its telephone lines to Whitfield, Ala. The company, it is said, contemplates an expenditure of about $400,000.

BETHANY, MO.—Plans are being made for increasing the output of the municipal electric light plant, which will include the installation of a new generator. J. F. Slinger is superintendent.

KANSAS CITY, MO.—Bids will be received at the office of the County Clerk, Court House, Kansas City, Mo., until Feb. 3 for the construction of a power and laundry building and smokestack at the Jackson County Home for the Aged and Infirm, at the County Farm near Little Blue. Specifications for said work may be seen at the office of Smith & Rea, architects, Dwight Building, Kansas City, Mo. Samuel A. Boyer is county clerk.

MAITLAND, MO.—Arrangements are being made by the Maitland Electric Light & Power Company to increase the output of its plant in the near future and extend its transmission lines to two towns, one two miles distant and the other seven miles, to furnish electricity for lamps. A Munzel gas engine and producer, manufactured by the Minneapolis Steel & Machinery Company, of Minneapolis, Minn., will be installed. T. R. Mueller is president and manager.

SEDALIA, MO.—The Sedalia Ice, Light & Fuel Company is considering the question of increasing the output of its plant and will install a 150-kw, 2200-volt, alternating-current generator in the near future. E. R. Andler is manager.

SENATH, MO.—The Senath Telephone Company has increased its capital stock from $6,000 to $20,000.

BILLINGS, MONT.—Surveys are being made and rights of way secured by the Billings & Cooke City Railway Company for its proposed electric railway, which will extend from Billings to Cooke City, a distance of 110 miles. The company expects to resume work in April. Electrical energy for operating the railway will be purchased from the Madison River Power Company. George H. Savage, of Billings, is secretary and general manager.

GLENDIVE, MONT.—The Hughes Electric Light Company is contemplating the installation of a steam heating system. Frank O. Hughes is secretary and manager.

MISSOULA, MONT.—The County Commissioners have granted to H. R. Wharton, of Butte, Mont., representing the W. A. Clark interests, a 50-year franchise to operate a street railway on the new Higgins Avenue Bridge and also the privilege of erecting transmission lines for the distribution of electricity for lamps and motors.

ALBION, NEB.—The citizens on Jan. 5 voted to issue bonds for the construction of a municipal lighting and heating system.

TONOPAH, NEV.—Surveys have been completed and work will soon commence on the erection of the transmission line of the Nevada-California Power Company to Round Mountain and Manhattan. The line to Manhattan will be 36 miles long.

LITTLETON, N. H.—The proposition to construct a dam on the Connecticut River between Dalton and McIndoes, Vt., has been revived. A Littleton company has the franchise for such a project.

MILTON MILLS, N. H.—Plans are being considered by John E. Townsend, owner of the local electric light plant, for the installation of a storage battery.

AVALON (P. O. PEERMONT), N. J.—The citizens on Dec. 22 voted against the proposition to issue $12,000 in bonds for a municipal electric light plant.

MENDHAM, N. J.—Plans are being considered to establish a municipal electric light plant for the borough, for which surveys have recently been made.

NEWARK, N. J.—Arrangements are being made by Willis Depuy, manager of the electrical department of the Montclair branch of the Public Service Corporation for extending the electric lighting service to the Borough of Roseland, N. J. Contracts have been placed for lighting about 30 residences. The company expects to secure a contract for lighting the streets of the borough, the system to be ready for operation in the spring.

RUTHERFORD, N. J.—The Borough Council has entered into a contract with the Public Service Corporation for lighting the streets of the borough for a term of three years. The company is to furnish all incandescent lamps at $16 per lamp for the first year and the other two years at $18 each per year; arc lamps at $80 each for the first year and $85 per lamp for the next two years. The company is to furnish three arc lamps and one incandescent lamp free of charge.

BERGEN, N. Y.—The Public Service Commission has authorized the village of Bergen to construct and maintain a municipal electric light plant and water-works system.

BROOKLYN, N. Y.—Bids will be received at the office of Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Jan. 15: No. 1, for providing all labor and materials required for the inspection and maintenance of electrical apparatus at the Kings County Hospital, Borough of Brooklyn; No. 2, for providing all labor and materials required for the inspection, maintenance and repairs to the elevators and motors, regulating devices and machinery on the base, with all devices thereunto necessary to maintain such in operative condition at the Cumberland Street Hospital, Borough of Brooklyn. The bidder will state one aggregate price for each contract, described and specified, as each contract is entire for a complete job. Blank forms and further information may be obtained at the office of the supervising engineer at the above office, where plans and specifications may be seen. Robert W. Hebberd is commissioner.

ITHACA, N. Y.—The Ithaca Telephone Company is making arrangements to extend its telephone line to Newfield, a distance of eight miles.

JAMESTOWN, N. Y.—Plans are being considered for the installation of a 500-kw steam turbine in the municipal electric light plant. Charles G. Sundquist is manager.

MINEOLA, N. Y.—The New York & North Shore Traction Company has applied to the Public Service Commission of the Second District

for a certificate of necessity and convenience to extend its Nassau County system into Queens County.

NEW YORK, N. Y.—The Board of Public Service Commission has granted a certificate of public convenience and necessity to the New York, Westchester & Boston Railway Company with a certificate approving the franchise to construct the railway.

NEW YORK, N. Y.—Bids will be received by the State Commission in Lunacy at the office of F. A. Wheeler, Ward's Island, New York, N. Y., until Jan. 18, for supplying New York State Hospitals with incandescent lamps for one year. Applications for specifications may be addressed to F. A. Wheeler.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Jan. 15, 1909, for providing all labor and materials for the inspection and maintenance of electric apparatus on Blackwell's Island, the central office, Bureau of Dependent Adults and Morgue, Borough of Manhattan, New York. Blank forms and further information may be obtained at the office of the supervising engineer of the department at the above office, where plans and specifications can be seen. Robert W. Hebberd is commissioner.

PATCHOGUE, N. Y.—The South Shore Traction Company has applied to the Public Service Commission for a franchise to extend its system through Jamaica, thence across the Queensboro Bridge.

PORTAGEVILLE, N. Y.—Plans are being made to erect a power plant at the grist mill dam and erect a transmission line to the Genesee Valley Blue Stone quarries, two miles distant. The equipment of the plant will include a 100-hp dynamo, two 15-hp motors with transformers.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has been granted permission by the Department of Public Works to construct and maintain an eight-duct conduit underneath the Erie Canal in Lyell Avenue.

SCHAGHTICOKE, N. Y.—An electric street lighting system of 40 incandescent lamps of 40 cp is being installed in this village. Electricity for operating the system will be furnished by the Schenectady Power Company, of Schenectady, N. Y.

MT. OLIVE, N. C.—Plans are being considered by the lighting committee to install a meter system or flat rate controller in connection with the municipal electric light plant. T. Eldridge is manager.

ROCKINGHAM, N. C.—It is reported that plans are being made for the reorganization of the Rockingham Power Company, which was recently placed in the hands of receivers. The company has a 30,000-hp power plant at Blewett's Falls, N. C., designed to furnish power to cotton mills in that section of the State.

BELFIELD, N. D.—The construction of an electric light plant in Belfield is under consideration.

AKRON, OHIO.—H. von Schon, of Detroit, Mich., consulting engineer, is preparing plans for the construction of a hydro-electric plant at the Cuyahoga Falls, Ohio, where a fall of 350 ft. will be utilized.

BUCYRUS, OHIO.—The injunction granted by Judge Babst on the petition of a taxpayer, restraining the city from issuing bonds for the construction of a municipal electric light plant, was dissolved by Judge Young on Jan. 4. The city voted to issue $90,000 in bonds for the construction of the plant.

CLEVELAND, OHIO.—The Massillon, Wooster & Mansfield Traction Company expects to commence work on construction of its railway this summer. The company proposes to furnish electricity for lamps. G. A. Bartholomew, of Cleveland, Ohio, is president and chief engineer.

ELYRIA, OHIO.—The Elyria Milling & Power Company is making extensive additions and improvements to its plant, which will include the installation of a 350-hp Trump water wheel, one 200-kw, 2200-volt, alternating-current Westinghouse generator, one 50-kw, direct-current Westinghouse dynamo and a 250-hp gas engine. J. E. Murbach is president and manager.

LIMA, OHIO.—Final plans and estimates for the construction of a municipal electric light plant have been submitted to the Board of Public Service by C. E. F. Ahlm, of Cleveland, Ohio, in compliance with the order of the court for an operative plant. According to the plans submitted the plant will cost $76,873, guaranteeing street arc lamps at $38.54 per year and to furnish electricity for commercial lighting at 2½ cents per kw-hour. The city is now paying the Ohio Electric Railway Company $85 per year for each arc lamp and from 6 to 12 cents per kw-hour for electricity for commercial purposes.

SPRINGFIELD, OHIO.—M. J. Bahin, city engineer, in his annual report to the Board of Public Service, recommends placing all electric and other wires underground in the business section of the city.

BARTLESVILLE, OKLA.—The Bartlesville Electric Light & Power Company is installing a 500-kw, 60-cycle, 2300-volt, alternating-current steam turbine, a 500-hp water-tube boiler and a new arc-lamp, street-lighting system, and about four miles of transmission lines. S. J. Smallwood is president and manager.

BLACKWELL, OKLA.—The Blackwell Electric Light & Power Company contemplates installing gas engines in its plant. Garrett Waite is president and manager.

PAWNEE, OKLA.—Plans are being considered to remove the municipal electric light plant about one mile from the present location. M. H. Bretz is manager.

WELEETKA, OKLA.—The Weleetka Light & Water Company contemplates the installation of a 150-kw unit to furnish electricity for a power service. G. H. Steger is manager.

CANBY, ORE.—M. J. Lee has been granted a franchise to install a light and power system in Canby.

PENDLETON, ORE.—The Peacock Milling Company has filed notice of appropriation of 5000 cu. in. of water on the Walla Walla River, which will be utilized to generate electricity.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 31 for furnishing electric motors. Blanks and general information relating to this circular (No. 488) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

AMBRIDGE, PA.—Surveys are now being made for the proposed electric plant of the Ambridge Electric Light, Heat & Power Company.

BIRDSBORO, PA.—The Birdsboro Electric Company is contemplating changing its system from single-phase 133 cycles to two-phase 60 cycles and establishing a day service. George Brooke, Jr., is president and manager.

CLARION, PA.—The Borough Council has granted the Clarion & East Brady Electric Railway Company a right of way through the borough. The company proposes to construct an electric railway from Clarion to East Brady via Sligo, a distance of 25 miles. G. E. Arnold, F. M. Arnold and T. S. Arnold, of Clarion, are interested in the project.

ELLWOOD CITY, PA.—Bids will be received by W. E. McElroy, borough clerk, until Jan. 19, for furnishing and installing complete the following equipment in the municipal electric light plant: One 140 to 150 hp vertical or horizontal gas engine, belted or direct-connected type; one 100-kw, two-phase, 2400-volt, 60-cycle, alternating-current generator, 720 r.p.m., and remodeling switchboard. Plans and specifications on file in office of the borough clerk.

McKEESPORT, PA.—The contract for furnishing electricity for lighting the new filtration plant and grounds has been awarded to the Monongahela Light & Power Company, of McKeesport, Pa., for a term of five years, at 3½ cents per kw-hour.

STOYESTOWN, PA.—The contract for lighting the city with arc and incandescent lamps has been awarded to the Stoyestown Light, Heat & Power Company for a term of one year, beginning Jan. 1, 1909. The company will also furnish electricity for lamps and motors for residences and manufacturing plants. Daniel Long is president.

PROVIDENCE, R. I.—The combination of all gas and electric companies in the Blackstone Valley, including those in the cities of Providence and Pawtucket, has been effected, for which purpose the Blackstone Gas & Electric Company was incorporated last year. A collateral trust bond of $5,000,000 to the Slater Company to cover the bondholders of the company has been filed in Pawtucket by Stone & Webster, of Boston, Mass. The new company is the holding corporation of the Pawtucket Gas Company, the Pawtucket Electric Company, the Woonsocket Gas Company and the Woonsocket Electric Machine & Power Company.

FLANDREAU, S. D.—The Moody County Telephone Company has taken over the telephone systems owned by Miller Brothers in Flandreau, Egan and Colman, and proposes to make improvements to the systems in the spring.

YANKTON, S. D.—The Yankton Telephone Company is erecting a new exchange building in Yankton and will install a new switchboard and equipment to cost from $6,000 to $13,000.

CORNERSVILLE, TENN.—The Lewisburg Light & Power Company is planning to extend its transmission lines from Lewisburg to Cornersville to furnish electricity for lamps. S. T. Hardison, of Lewisburg, Tenn., is president of the company.

MEMPHIS, TENN.—The Merchants' Power Company has commenced work on the construction of its new annex to the main power plant on Keel Street. The new plant will be used as an auxiliary and will be equipped with a turbine engine with a rating of 1500 hp. It is said that the company contemplates furnishing electricity for residential lighting. Up to the present time the company has confined its service to commercial lighting. The cost of the addition is estimated at $50,000.

BRYAN, TEX.—The citizens have petitioned the City Council to call an election to vote on the proposition to issue bonds, the proceeds to be used to secure a better light and water service and for a sewerage system.

EL CAMPO, TEX.—It is reported that the new owners of the electric light plant, water works and ice factory, formerly owned by the El Campo Light, Water & Ice Company, contemplate making improvements to the plant. A. L. Strang, of New York, N. Y., is president of the company.

GRANBURY, TEX.—The Frisco Ice & Light Company is contemplating the installation of an additional 25-kw, 1100-volt generator and a 40-hp engine. R. E. Doyle is manager.

HUBBARD CITY, TEX.—The Union Central Light & Ice Company contemplates building a new electric lighting plant and an addition to its ice factory. W. A. Bass is president and manager.

JEFFERSON, TEX.—The Jefferson Ice, Light & Power Company contemplates installing a producer gas plant. John T. McDonald is owner and manager.

MARBLE FALLS, TEX.—The establishment of a hydro-electric plant at this place is under consideration by a syndicate. H. von Schon, of Detroit, Mich., consulting engineer, has been retained to investigate and report on the development considering water storage, for which surveys are now being made under his direction.

MARSHALL, TEX.—The Marshall Traction Company is planning to begin construction of its local street railway early this year. A contract has already been placed for the construction of three-fourths of a mile. The railway will be about four miles long and will be operated by electricity. M. Turney, of Marshall, is manager.

PORTSMOUTH, VA.—The City Council is considering the question of installing a municipal electric light plant, the cost of which is estimated at $75,000. The Council also contemplates advertising for bids for a franchise to install and operate an electric light plant in the city. The contract for street lighting with the Norfolk & Portsmouth Traction Company expires within a few months.

RICHMOND, VA.—The Virginia Passenger & Power Company is planning to make additions and improvements to its plant, which will include the installation of a 900-kw and a 750-kw alternator, a 4000-kw steam turbo-generator set, two 1500-hp water wheels and an 1800-hp boiler. G. H. Whitfield is general superintendent of light and power department.

BETHEL, VT.—The Gaysville Power Company is planning to install a 600-hp engine in its power house, contract for which has been placed. C. D. Cushing is superintendent.

BRATTLEBORO, VT.—Preparations are being made by the Estey Organ Company to equip its plant to be operated by electrical power, which will be furnished by the Connecticut River Power Company's plant when completed. A substation will be erected at the Estey company's plant, to which electricity will be transmitted at 10,000 volts. The station will be equipped with three transformers and a high-tension switchboard. The organ plant will be equipped with 60 motors, aggregating 400 hp, ranging from ¼ hp to 75 hp. The motors will be furnished by the Crocker-Wheeler Company, of Ampere, N. J.

WALLINGFORD, VT.—The Rutland Railway, Light & Power Company has decided to extend its transmission lines to Wallingford to furnish electricity for lamps and motors, and will also furnish energy to the Wallingford Manufacturing Company, which proposes to change its motive power from steam to electricity. It is expected that the town will vote to install electric lamps for street lighting, to take the place of the oil lamps now in use, of which there are 45.

BELLINGHAM, WASH.—The Home Telephone Company contemplates making extensive extensions to its local system, which will involve an expenditure of about $50,000.

BREMERTON, WASH.—The Peninsular Light & Power Company has been granted a franchise by the City Council to supply electricity for lamps and motors in Bremerton. The company also received a similar franchise in the town of Port Orchard. The company proposes to develop water power in Dosewallip River on Hood Canal to generate electricity, which will be transmitted to Bremerton and Port Orchard.

CLE ELUM, WASH.—The City Council has granted a franchise to Frank S. Farquhar, of Tacoma, Wash., to operate an electric railway in Cle Elum; also to furnish electricity for commercial purposes. The railway will be operated under the name of the Cle Elum-Roslyn Electric Railway & Power Company. The company will extend its railway to Roslyn, a distance of 10 miles. Application has been made to the Roslyn Council for a railway franchise.

FAIRFIELD, WASH.—Messrs. Nixon & Kimmel have applied for a franchise to erect an electric transmission line and telephone line between Waverly and Fairfield, for a distance of about 4½ miles. It is proposed to connect systems now in operation in the two towns.

HOQUIAM, WASH.—The Grays Harbor Railway & Light Company will replace its wooden poles with steel poles and install cluster lamps.

HOQUIAM, WASH.—The Pacific States Telephone Company will petition the City Council for a franchise in this city and if granted will expend from $8,000 to $12,000 in improving the service.

MONROE, WASH.—The Independent Telephone Company is planning to extend its telephone line to Cherry Valley.

SEATTLE, WASH.—The citizens on Dec. 29 voted to issue $800,000 in bonds, the proceeds to be used to enlarge and improve the municipal electric light plant.

SEATTLE, WASH.—R. H. Thomson, city engineer, has submitted estimates of the cost of installing arc lamps on Fourth Avenue and Fourth Avenue South, from Pike Street to Jackson Street, placing the cost at $30,000.

SPOKANE, WASH.—The Spokane, Columbia & Western Railway Company has applied to the City Council for a franchise to enter the city.

SPOKANE, WASH.—William A. Nicholls, president of the Big Bend Transit Company, states that his company owns water rights on the Spokane River capable of developing 25,000 hp, and will commence at once work on construction of an electric plant, starting with 10,000 hp.

TENINO, WASH.—It is reported that arrangements have been completed whereby the telephone exchange, the light and power company and the water-works systems will be owned and controlled by W. Dean Hays and S. W. Fenton. The new owners propose to make extensive improvements to all three systems.

WALLA WALLA, WASH.—It is reported that the Spokane Inland Electric Railway Company contemplates extending its railway from its present terminus to Walla Walla, a distance of 75 miles.

BELINGTON, W. VA.—The capital stock of the Consumers' Heat, Light, Water & Power Company has been increased from $60,000 to $135,000.

ATHENS, WIS.—The Athens Electric Light & Power Company is contemplating the installation of larger generators. William L. Erbach is vice-president and manager.

BRILLION, WIS.—The Wayside Telephone Company has been granted permission to build its telephone lines into Brillion and connect with the local system.

LA CROSSE, WIS.—The City Council has decided to expend $500 to secure the services of an expert to make investigations and decide upon the feasibility of operating a municipal electric light plant in connection with the water works system. The cost of the plant is estimated at $45,000.

MILWAUKEE, WIS.—Bids will be received at the office of the Board of Public Works until Feb. 17 for furnishing and erecting complete in building and foundations to be furnished by the city of Milwaukee all the machinery and appurtenances necessary for the complete installation of a gas-producer and gas-engine electric lighting plant, according to plans and specifications on file at this office. The work to be completed within 10 months from date. Plans and specifications will be furnished to prospective bidders on the receipt of $25 as a guarantee for their safe return. August M. Gawin is comptroller.

KEMMERER, WYO.—The Frontier Supply Company is planning to increase the output of its plant by 150 kw. P. J. Quealy is president and manager.

CALGARY, ALB., CAN.—The Street Railway Commissioners have mapped out the route for the proposed municipal street railway system which will be built in the spring. With the exception of a line to Hillcrest, no suburban lines will be built until next year. For further information, address Mayor Jamieson.

EDMONTON, ALB., CAN.—The City Council has voted $280,000 for extensions to the electric light, power and water plants. For further information, address Mayor Macdougal.

EDMONTON, ALB., CAN.—The town of St. Albert has offered a bonus to the Edmonton Radial Railroad Company to construct a branch line to that town. For further information, address Mayor Macdougal.

KELOWNA, B. C., CAN.—The Hinton Electric Company, of Vancouver, B. C., is installing an electric lighting plant in Kelowna at a cost of $40,000.

PRINCE RUPERT, B. C., CAN.—A telephone system will be installed in Prince Rupert by the Grand Trunk Pacific Railroad Company for the use of the residents of the town.

WINNIPEG, MAN., CAN.—Tenders are being called for a 50-light outfit (magnetite lamps) for the municipal electric light plant. F. A. Cambridge is city electrician.

WINNIPEG, MAN., CAN.—Tenders were accepted at the last meeting of the Council for work on the civic power plant, costing approximately $1,500,000, all of which was excavation and concrete work, with the exception of wire.

WINNIPEG, MAN., CAN.—The Board of Engineers has recommended to the City Council that the contract for the general work at Point du Bois be awarded to John Gunn & Sons, for $779,100; for the erection of the transmission system, to the Power Construction Department, for $89,680; for aluminum transmission cable to the Northern Aluminum Company, for $148,050, and the contract for steel towers for the transmission line to the Manitoba Iron Works, at an estimated cost of $87,550. Smith, Kerry & Chace have charge of the engineering work.

BRANTFORD, ONT., CAN.—Arrangements are being made by the Lyons Electric Company to install a storage battery in its power house, and later the company expects to duplicate its plant.

GLENCOE, ONT., CAN.—The Council has awarded the contract for the erection of a gas producer power plant for the municipal electric light plant to the Colonial Engineering Company, of Montreal, Que. The contracts for electrical equipment and distributing system have also been awarded.

LONDON, ONT., CAN.—Superintendent Nixon, of the Grand Trunk Railroad, announces that the telephone system is to be used for dispatching trains on the London division.

LONDON, ONT., CAN.—A. E. Welch, general manager of the North Midland Railway Company, writes that surveys have been completed for its proposed road and it is expected to commence work on the construction of the road this spring. The railway will be 45 miles in length and connect Lucan, Granton, St. Marys, Stratford and London. W. Scarlet, of London, Ont., is president.

TORONTO, ONT., CAN.—William Mackenzie, president of the Electrical Development Company, states a tramway will be built by the company from here to Niagara Falls along the route of its transmission line.

WELLANDPORT, ONT., CAN.—The Dunnville, Wellandport & Beamsville Electric Railway Company will commence work in the spring on the construction of its road from Dunnville through Wellandport to Beamsville, a distance of 23 miles. James A. Ross, of Wellandport, is president.

MONTREAL, QUE., CAN.—The Montreal Light, Heat & Power Company has decided not to continue for a short time to furnish electricity for lighting the streets of the city at the rate paid under the present contract, which expired Jan. 1, 1909. It is said that the company will continue the service for 15 nights without charge to the city, and if no arrangement is made by that time the service will be discontinued.

SASKATOON, SASK., CAN.—The ratepayers have approved a by-law providing for extensions to the municipal electric lighting plant to cost $30,000. For further information, address Mayor Clinskill.

New Industrial Companies.

THE AMERICAN WIRE CABLE COMPANY, of Wilmington, Del., has been chartered, with a capital stock of $50,000, by Ernest L. Squire, J. A. Byrne, K. M. Byrne, of Wilmington, Del.

THE NEW JERSEY MONORAIL CONSTRUCTION COMPANY, of Wilmington, Del., has been incorporated, with a capital stock of $1,500,000, by E. D. Thompson, H. H. Haines, of Philadelphia, Pa., and H. Whitely, of Wilmington, Del.

THE SCHOTT ENGINEERING COMPANY, of Portland, Maine (architects and engineers), has filed articles of incorporation, with a capital stock of $1,000,000. The officers are: C. E. Eaton, president, and T. L. Croteau, treasurer, both of Portland, Maine.

THE EXCELLO ARC LAMP COMPANY, of Chicago, Ill., has filed articles of incorporation in Illinois to sell electrical appliances and fixtures. The company is a New York corporation and its Chicago office will be located at 118 West Jackson Boulevard, Chicago, Ill.

THE ACME METAL MANUFACTURING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $5,000, by James H. Beets, L. Betts Hengerer and Charles D. Winters, of New York, N. Y. The company proposes to manufacture electrical advertising signs.

THE O. K. ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture machinery and engines for heating and lighting plants. The incorporators are: Daniel Gerlach, Dora Gerlach and Amanda Gerlach, all of New York, N. Y.

THE LOCKWOOD ENGINEERING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $50,000, by G. E. Cook, New York, N. Y.; T. Culhane, of Niskayuna, N. Y., and W. D. Lockwood, of Schenectady, N. Y. The company proposes to do a general contracting business.

THE TRIAD MACHINE COMPANY, of Paterson, N. J., has been incorporated, with a capital stock of $100,000, by George Cartwright, George E. Hannah and William Wright, of Paterson, N. J. The company proposes to manufacture mechanical, electrical, civil engineers' and machinists' tools.

THE W. E. CHIPMAN COMPANY, of Boston, Mass., has been incorporated with a capital stock of $50,000 and the following-named officers: William E. Chipman, president; William E. Ludden, treasurer and clerk, both of Boston, Mass. The company proposes to do a general electrical construction business.

THE ANTI-ELECTROLYTIC COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $500, to manufacture protective settings for metallic bodies in concrete. The incorporators are: Robert S. Crocker, Josiah Macy, of New York, N. Y., and Albert H. Vernam, of Morristown, N. J.

THE ECLIPSE ELECTRICAL CONSTRUCTION COMPANY, of New York, N. Y., has been chartered, with a capital stock of $1,000, by Cornelius Campbell, of Passaic, N. J.; Matthew H. Farrar and William R. Lockwood, both of Brooklyn, N. Y. The company proposes to do general contracting and electrical work.

THE WILLIAM HUNTER MACHINE COMPANY, of Hoboken, N. J., has filed articles of incorporation, with a capital stock of $25,000. The incorporators are: W. Hunter, W. Clark, of Hoboken, N. J., and J. H. Susse, of Union, N. J. The company proposes to carry on a business of mechanical engineering and general machinists.

THE O'BRIEN ELECTRICAL TUBULAR LAMP COMPANY, of Camden, N. J., has been chartered, with a capital stock of $300,000, to manufacture electric and gas lamps, globes, tubes, signs, novelties, etc., by Walter C. Waldron, Brooklyn, N. Y.; William P. Fairman, of Philadelphia, Pa.; Dennis J. O'Brien, Philadelphia, Pa.; Matthew Jefferson, of Camden, N. J.

New Incorporations.

CHENOA, ILL.—The Chenoa Telephone Company has been chartered, with a capital stock of $5,000. The officers of the company are: John N. Gentes, president; W. R. Shinn, secretary, and John F. Johnson, treasurer.

DORCHESTER, ILL.—The Dorchester Telephone Company has been incorporated, with a capital stock of $1,875, by D. M. Thompson. Henry H. Bauer and F. B. Luben.

KENTLAND, IND.—The Kentland Light & Ice Company has filed articles of incorporation, with a capital stock of $50,000. The company proposes to build and equip a combined plant to furnish heat, light, water and ice to the inhabitants of Kentland. Clearmont Rider is president.

WODEN, IA.—Articles of incorporation have been filed for the Woden Farmers' Telephone Company, with a capital stock of $2,000.

AUGUSTA, MAINE.—The International Light & Power Company has filed articles of incorporation, with a capital stock of $1,000,000, for the purpose of supplying gas and electricity. J. Berry is president and treasurer, and J. Williamson, clerk, both of Augusta, Maine.

KITTERY, MAINE.—The Automatic Electric Power Company has been incorporated, with a capital stock of $100,000. The purpose of the company is to operate water, gas and electrical works. The officers are: G. E. Burnham, president, and E. J. Burnham, treasurer and clerk, both of Kittery, Maine.

PORTLAND, MAINE.—The Atlanta, Birmingham & Coast Company has filed a certificate of organization with the Secretary of State. The company is capitalized at $3,000,000 and proposes to construct and operate railroads, telegraph and telephone lines; also electric and gas plants. The officers of the company are: Elgin C. Verrill and Philip G. Clifford, both of Portland, Maine.

ADAIR, MICH.—A new telephone company has been organized, to be known as the Casco Roadway Company, with the following named officers: Louis Maedel, president; William Eschenberg, vice-president; Henry Lutes, secretary, and Joseph Cobbledick, treasurer.

AU SABLE, MICH.—Articles of incorporation have been filed for the Eastern Michigan Power Company, with a capital stock of $10,000, by E. F. Loud, R. H. Loud, of Au Sable, Mich., and N. S. Potter, of Jackson, Mich. The company proposes to develop water power to generate electricity. The company is authorized to do business in all counties in this part of the State.

BROWNSVILLE, MINN.—The Brownsville Telephone Company has been organized for the purpose of consolidating all of the local farm and village telephone lines. The directors are: Charles Fetzner, William Lieker and Stephen Enos.

LONG LAKE, MINN.—The Long Lake Rural Telephone Company has been organized and the following-named officers elected: George Sinclair, president; Gust Carlson, vice-president; John Sandegren, secretary, and A. N. Barb, treasurer.

CENTERVILLE, MO.—The Centerville Telephone Company has been formed to operate a telephone line extending from Newville to Centerville. The officers of the company are: Glen D. Williams, president; Glen D. Mains, vice-president, and Frederick Dunlap, secretary and treasurer.

BARTLEY, NEB.—The Bartley Mutual Telephone Company has been incorporated, with a capital stock of $12,000, by Edward Sughrause, D. L. Wolf and others.

COTTONWOOD GROVE, NEB.—The Cottonwood Grove Mutual Telephone Company has been organized, with a capital stock of $700, by John Henry, J. H. Hover and others.

EAST ORANGE, N. J.—The General Service Heat & Power Company has been chartered, with a capital stock of $100,000, by J. M. W. Kitchen, F. R. Wickes, H. H. Pickling, of East Orange, N. J. The company proposes to generate and distribute light, heat and power.

BROOKLYN, N. Y.—Articles of incorporation have been filed for the Flatbush Railroad Company by John C. Langan, of Brooklyn; J. J. Boughman, of New Cumberland, Pa., and P. S. Sadler, of Carlisle, Pa. The company proposes to construct and operate an electric street railway from the Brighton Beach line of the Brooklyn Union Elevated Railroad Company at Avenue Q to Avenue Q and Flatbush Avenue, Borough of Brooklyn, a distance of three miles. The company is capitalized at $30,000.

BUFFALO, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Federal Telephone & Telegraph Company. The capital stock is placed at $6,000,000 and the company proposes to operate telephone and telegraph lines in the principal cities, towns and villages in the State. The directors are: E. G. Hubbell, W. H. Andrews, C. C. Machemer, R. W. Chapin, G. A. Plimton and others, of Buffalo, N. Y., and G. D. Morgan, of Rochester, N. Y.

RENSSELAER FALLS, N. Y.—The Rensselaer Falls Electric Light & Power Company has been incorporated, with a capital stock of $2,000, to operate an electric light and power plant. The incorporators are: Frank Morrison, William S. Blair, Benjamin F. Morrison, Eugene Morrison, all of Rensselaer Falls, N. Y.

GREENSBORO, N. C.—A charter has been granted to the Randolph Power Company, with a capital stock of $100,000, to furnish electricity for light and power. The incorporators are: C. W. and H. C. Petty and M. W. Parrish, all of Greensboro, N. C.

COLUMBUS, OHIO.—The Arthur Telephone Company, of Arthur, Paulding County, has been incorporated by Claude Morris and others.

POLK, OHIO.—The Polk Rural Telephone Company has been incorporated, with a capital stock of $8,000, by John F. Smith and others.

TOLEDO, OHIO.—Articles of incorporation have been filed with the Secretary of State at Lansing, Mich., for the Ohio & Michigan Southern Railroad Company, with a capital stock of $17,000,000. The new company proposes to take over the property of the Toledo, Ann Arbor & Detroit Railway Company, which is a partially completed electric railway between Toledo, Ohio, and Ann Arbor, Mich., and equip the road for both freight and passenger service. The directors are : Andrew E. Lee, of Vermillion, S. D.; John O. Zazel, of Toledo, Ohio.; D. F. Niles, of Duluth, Minn., and N. A. Reese, of Chicago, Ill.

PAWNEE, OKLA.—The Coal Creek Telephone Company has been incorporated, with a capital stock of $300, by W. J. Nail, John Wolfe and J. M. McKill.

GRANTS PASS, ORE.—The Citizens' Telephone Company has been formed, with a capital stock of $30,000, by H. D. Norton, Arthur Conklin and E. A. Marsh. The company will soon apply for a city and county franchise.

HOOD RIVER, ORE.—Articles of incorporation have been filed for the Watt Development Company by J. F. and A. S. Watt, of Hood River. The company owns valuable water rights on Hood River, located about five miles from Hood River, known as the Tucker power site. It is said that from 5000 to 10,000 hp is available. Work on development will begin at once.

PORTLAND, ORE.—Articles of incorporation have been filed for the Columbia Telephone Company of Oregon by T. L. Evans, W. C. Hicks and Fred C. Reed. The company is capitalized at $1,200.

PORTLAND, ORE.—Articles of incorporation have been filed for the Portland Water Power & Electric Company, with a capital stock of $1,000,000. The company proposes to construct a dam and power plant on the Clackamas River near Estacada, work on construction of which will begin at once. W. H. Hulbert, former president of the Oregon Water Power & Railway Company; A. B. Crossman and R. L. Durham are interested in the enterprise.

PRICETOWN (P. O. FLEETWOOD), PA.—The Pricetown Rural Telephone Company has been organized and the following-named officers elected: S. J. Hill, president; D. H. Manwiller, secretary, and G. W. Brown, treasurer.

SCHAEFFERSTOWN, PA.—The Schaefferstown Rural Telephone Company has been organized to operate a telephone system in the southeastern portion of Lebanon County and part of Berks County. The capital stock is placed at $5,000 and the officers are: F. B. Horst, of Reistville, Pa., president; J. T. Gable, of Horst Hill, Pa., vice-president; Alvin Schaeffer, of Schaefferstown, Pa., secretary, and S. H. Bomberger, of Schaefferstown, treasurer.

IPSWICH, S. D.—The Union Township Telephone Company has been incorporated, with a capital stock of $10,000, by S. W. Mount, E. L. Bucklen, John Sloan, H. Strouble and George Fritz, all of Union Township.

SAN AUGUSTINE, TEX.—Articles of incorporation have been filed for the San Augustine Light & Power Company, with a capital stock of $6,000, by F. K. Nance, W. N. Foster and T. L. Foster.

TYRONE, TEX.—The Farmers' Telephone Company has been organized, with a capital stock of $2,000. The officers of the company are: W. M. Atkins, president; William Dixon, vice-president, and Robert Harville, treasurer.

NORTH YAKIMA, WASH.—The Wenas Telephone Company has been incorporated, with a capital stock of $5,000, by George Longmire and others.

MORGANTOWN, W. VA.—The National Telephone Company, of Monongalia County, has been chartered to control and operate the systems of the People's Telephone Company, of Morgantown, W. Va.; the Consolidated Telephone Company, of Fairmont, Va., and the West Virginia Western Telephone Company, of Parkersburg. The company is capitalized at $50,000, and the incorporators are: W. C. Handlan, S. W. Harper, of Wheeling, W. Va.; C. E. Manley, J. W. Barnes and E. F. Hardy, of Fairmont, W. Va.

RICHMOND, ONT., CAN.—The Malahide & Bayham Telephone Co-operative Association has been formed here, with a capital of $10,125.

THORNDALE, ONT., CAN.—The East Middlesex Telephone Company has been incorporated, with a capital of $30,000. The incorporators are: R. L. Guest, of London Township; R. T. Wright and F. W. Hughes, of Thorndale, Ont.

REGINA, SASK., CAN.—The Regina Inter-Urban Tramway Company has been incorporated, with a capital of $350,000, by J. L. R. Parsons, W. M. Logan and J. F. Frame, of Regina, Sask.; R. R. Barger, of Georgetown, Ont.; C. J. Harris, of Brantford, Ont., and J. H. Housser, of Toronto, Ont

Legal.

DANGERS OF LIVE WIRES.—The Indiana Appellate Court in case of Ambre vs. Postal Telegraph Company decided that a servant employed by a telegraph company to "locate trouble," by testing its wires which were strung on the same poles with other wires which he knew belonged to and were used by an electric light company, was not chargeable with notice that the electric light wires were carrying a dangerous charge at 4 o'clock p. m., and his right to recover for injuries cannot be defeated on the ground that he was bound to assume that the electric light wires were "live wires."

Company Elections.

SHELBYVILLE, IND.—The directors of the Shelbyville Gas & Light Company have elected the following officers: E. A. Potter, Chicago, Ill., president; John H. Leefers, vice-president; O. D. Obadon, secretary, and G. H. Dunn, treasurer. The directors voted to make substantial improvements and extensions to the plant this year.

Personal.

MR. W. STANLEY, JR., has recently passed through a severe attack of pneumonia and has gone South to recuperate and to woo complete health.

MR. ROMIE W. WILSON has been appointed superintendent of construction for the Manchester Traction, Light & Power Company, Manchester, N. H., to succeed the late Mr. George N. Burpee.

MR. E. E. PEAKE has resigned as superintendent of the Sherman, N. Y., Electric Light Company to accept the position of secretary and general manager of the Genesee Valley Power Company, of Olean, N. Y.

MR. LESLIE R. HICKS, formerly in charge of the electric lighting department at Elgin, Ill., of the Aurora, Elgin & Chicago Railroad Company, has become electrical engineer of the Fall River (Mass.) Electric Light Company.

MR. C. D. WOOD, JR., has resigned his position as treasurer of the Electric Home Supply Company, of New York City. His present business address is the Heinrich Electric Novelty Company, 192 Fulton Street, Brooklyn, of which he is president.

MR. W. R. GARTON, general manager of the Lord Electric Company, returned last week from a five-week trip through Canada and the Northwestern States. He says that business conditions are vastly improved in the sections through which he traveled.

MR. HUGO REISINGER, of New York City, well known as an importer in the electrical trade, has been elected an honorary life member of the Metropolitan Museum of Art. He had a great deal to do with the present excellent exhibition there of contemporaneous German art.

MR. H. L. MONTGOMERY succeeds Mr. M. C. Turpin as general manager of the Auburn (N. Y.) Light, Heat & Power Company. Mr. C. A. Callendar, late assistant superintendent, is now superintendent. Mr. Eugene Creed succeeds Mr. Montgomery as New Business manager.

MR. H. A. OSTRANDER has resigned as superintendent of the municipal water and light systems at Salamanca, N. Y., and has accepted the management of the Salamanca Veneer-Panel Works, of Salamanca, N. Y. Mr. H. E. Heller will succeed Mr. Ostrander as superintendent of the water and light systems.

MR. J. W. PUTNAM, who resigned last month as assistant engineer of the Toronto & Niagara Power Company, has accepted the position of general manager with the recently incorporated firm of Overhead & Underground Construction Company, 2 Rector Street, in the new United States Express Company's Building, New York City.

MR. WALTER S. BISSELL has become the treasurer of the F. Bissell Company, of Toledo, Ohio. He has been associated with that concern for a number of years as one of its traveling salesmen, and brings to his new position a thorough knowledge of the electrical industry and trade, as well as an intimate and wide acquaintance with those engaged in the field.

MR. J. J. ESTABROOK, secretary and vice-president of the Engineering Specialty Company, of Stamford, Conn., resigned from that position on Jan. 1 and is not now connected with that concern. He is locating in the Havemeyer Building, Cortlandt Street, New York City, and will handle there a full line of standard and special motors, motor generators, etc.

MR. HENRY C. MORRIS, for several years assistant general manager of the Bay City Traction & Electric Company and the Bay City Gas Company, of Bay City, Mich., which are controlled by Hodenpyle, Walbridge & Company, has resigned and will become connected with the management of the gas interests in Texas, owned by Hodenpyle, Walbridge & Company.

MR. H. VON SCHON, of Detroit, Mich., is preparing plans for a 6000-kw hydro-electric plant on the Sturgeon River, Mich., the power to be transmitted to the copper region near Houghton; also plans for an 8000-hp hydro-electric plant at Cuyahoga Falls, Ohio, having a head of 330 ft. Mr. von Schon has also been retained to report on the hydro-electric development of Marble Falls, Tex.

MR. E. T. MUNGER, former superintendent of motive power and equipment of the Metropolitan West Side Elevated of Chicago, has been made general superintendent of the Hudson Tunnel system. He is a graduate of the University of Wisconsin of the class of 1892. He served

the Chicago Elevated from 1894 to 1898, and re-entered its service in 1903, after five years' service on electric traction lines.

MR. DOUGLAS GORDON, who has been connected with an American engineering company as manager for a number of years, is making arrangements to establish himself in London next April, and desires to get in touch with American machine and supply manufacturers, with a view to selling their products in the British Isles. His present address is 165 Naples Road, Brookline, Mass. He will be glad to hear from electrical concerns.

MR. A. A. TIRRILL has resigned from the engineering department of the General Electric Company and will now devote his time to the manufacture of electrical supplies and specialties, for which he has recently incorporated an organization to be known as the Tirrill Manufacturing Company, of Schenectady, of which he is president. Mr. Tirrill is the inventor of the well-known Tirrill voltage regulator. His further work in the electrical field will be followed with much interest.

MR. WALTER STUART KELLEY, who has been connected with the Holtzer-Cabot Electric Company for several years as chief engineer, terminated his connection with them Jan. 1. Mr. Kelley has given his attention for some time largely to alternate-current design and has developed several new forms of remarkably light weight, including both generators and motors. An interesting example is a wireless set consisting of 3-kw generator and exciter with gasoline engine mounted on common base, weighing, complete, 375 lb.

MR. L. H. DAVIS, who has been general superintendent of railway, light and ferry properties of the Norfolk & Portsmouth Traction Company, Norfolk, Va., has been appointed general superintendent of floating properties of the company, including the Portsmouth, Norfolk and Berkley ferry systems, the ferry between Willoughby Spit and Old Point Comfort, the ferry between Newport News and Sewalls Point and the Pinners Point and West Norfolk ferry. Mr. H. Root Palmer has taken over the lighting department at Portsmouth as general superintendent of lighting, and Mr. J. L. Adams has taken over the railway department as general superintendent of railways. Because of Mr. Davis's residence in Portsmouth, he has been appointed general agent, reporting directly to Mr. E. C. Hathaway, general manager, and through him to the president.

Trade Publications.

THE ARTHUR JONES COMPANY, 84 Van Buren Street, Chicago, Ill., is sending out a new stock list on new and second-hand motors and generators, of which this company carries a large stock.

ART GLASS SIGNS.—The Auto-Electric Sign Company, 134 Van Buren Street, Chicago, Ill., has issued a circular calling attention to its color-changing art glass signs. These signs are made of galvanized steel and are strongly reinforced to withstand severe usage.

NEW TELEPHONE MOUTHPIECE.—R. E. Miller, Lakewood, N. M., inventor and patentee of a new telephone transmitter mouthpiece, is sending out circulars calling the attention of the trade to his new device. The mouthpiece is constructed in sections and contains a small chamber in which a disinfectant can be placed.

PNEUMATIC WATER SYSTEMS.—The United Pump & Power Company, Chicago, Ill., has issued a new catalog of the Perry pneumatic water systems. This company has recently secured patents on a new type of Perry automatic controller which is designed to be used in connection with pneumatic pumps.

POCKET TELEPHONES.—The Stolz Electrophone Company, 92 State Street, Chicago, Ill., has issued a small 16-page catalog, calling attention to its pocket telephone which has been devised for remedying defective hearing. The catalog contains cuts made from photographs of the Stolz electrophones and of various methods of using them.

MOTORS AND INSTRUMENTS.—The Wagner Electric Manufacturing Company, St. Louis, Mo., announces that new bulletins are in preparation on "Polyphase Motors," "Single-Phase Motors," "Synchronous Motors," "Alternating-Current Elevator Motors" and "Instruments." The company has recently sent out bulletins on "Central-Station Transformers" and "Power Transformers."

THE HARVARD ELECTRIC COMPANY, Chicago, Ill., is sending out circulars containing illustrations and descriptions of the Harvard battery and the Harvard copper test connectors. The company is also sending out an illustrated circular calling attention to its toll line protector, designed especially for telephone toll lines in rural districts and for other services where a large carbon lightning arrester without fuse is desired.

ADJUSTABLE-SPEED MOTORS.—A typographical error on page 1425 of our issue for Dec. 26 caused the statement to appear that a certain line of motors provides a speed variation of 62 to 1. The motors are adjustable-speed machines which, although not giving the range erroneously stated, have the exceptionally wide range of 6 to 1. They are well described in Bulletin No. 59 of the Northern Electrical Manufacturing Company, Madison, Wis.

SERIES ALTERNATING ARC LIGHTING.—In Bulletin No. 4631, just issued by the General Electric Company, is described its series alternating enclosed arc light system. The bulletin contains a detailed description of the constant current transformers, constant current transformer panels, enclosed arc lamps, arc lamp cut-outs and lightning arresters used in connection with this system, together with various connection diagrams and illustrations of parts.

ELECTRIC HEATING APPARATUS.—The Metropolitan Electrical Supply Company, Chicago, Ill., is sending out a special catalog and circulars calling attention to the electrical heating apparatus manufactured by the American Electrical Heater Company, for which it is the agent. Special attention is called to the electric laundry irons, which are put up in special decorated boxes for holiday gifts. This company is also handling a new style of luminous radiator which is also made the subject of circular matter.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is issuing a comprehensive circular descriptive of "Opalux" shades and reflectors. The circular contains a number of photometric curves which were developed through tests made by the Electrical Testing Laboratories, of New York. "Opalux" shades and reflectors, when used with tungsten lamps, are claimed by the company to give the most satisfactory results, and should prove of great interest at this time when the subject of illumination is receiving so much attention.

MERCURY ARC RECTIFIERS.—Bulletin No. 4628 of the General Electric Company deals with the latest types of mercury arc rectifiers made by it. Designed primarily for 60 cycles, they will work on any frequency from 60 to 140 inclusive, and can be supplied for as low as 25. It is designed for operation on either 110 or 220 volts alternating, but tubes are furnished for any commercial secondary alternating current current voltage. A number of applications are shown with outfits for the purpose. These are accompanied by dimension diagrams.

SERIES LUMINOUS ARC RECTIFIER SYSTEM.—Those interested in street illumination will be also interested in the General Electric Company's Bulletin, No. 4620, describing its series luminous arc rectifier system, which forms a striking contrast to the older open arc system of lighting. The bulletin goes more or less into details and describes the various pieces of apparatus used in connection with the system, including are lamp hangers and cut-outs, constant current transformers, mercury arc rectifier tube, switches for use in connection with the system, etc. It contains also dimensions and connection diagrams.

MOTOR-GENERATOR SETS.—Bulletin No. 4633, devoted to the subject of motor-generator sets, has just been issued by the General Electric Company:—Direct current to direct-current sets, alternating current to direct-current sets, or vice versa, varying in capacity from 0.2 kw to 1500 kw, and alternating current to alternating-current sets between two periodicities, commonly called "frequency changers." The different sets are briefly described and illustrated, and illustrations of several installations of such sets are shown. The bulletin, quarto shape, contains, also, tables of weights and dimensions of the various sets.

JOHNS-MANVILLE CATALOG.—A new catalog, entitled "Pipe and Boiler Insulation," has just been issued by the H. W. Johns-Manville Company, of New York. This book is devoted to a thorough presentation of the problems of insulating all kinds of heated and cooled surfaces, such as pipes, boilers, furnaces, flues, ducts, etc., as well as insulation for refrigerating and cold storage work. The book is most complete and bears out the company's idea, "a covering for every condition." It is handsomely illustrated and printed. A copy can be secured by addressing the company's nearest branch and asking for Catalog No. 100.

Business Notes.

MR. RICHARD WICK, formerly associated with the Western Wire Sales Company, Chicago, Ill., has opened up offices at 356 Dearborn Street, Chicago, and will hereafter engage in the sale of bare and insulated wires and cables.

ELECTRICALLY-DRIVEN ARMATURE DISK PRESS AND FIELD-COIL WINDER.—James Clark, Jr., Electric Company, Louisville, Ky., has recently placed on the market a new electrically-driven notching press for armature disks and an electrically-driven winding machine for field coils.

THE AMERICAN ELECTRIC FUSE COMPANY, Muskegon, Mich., states that its "American Igniter" is receiving much favorable attention from prominent engineers of the country. This igniter is a new device designed for gasoline engine ignition purposes and is to be mounted directly on the timer or cam shaft of gasoline engines for automobile, marine or stationary-engine uses.

DE RONDE INSULATING PAINTS AND COMPOUNDS.—The Metropolitan Electrical Supply Company, Chicago, Ill., reports that it is making large sales of De Ronde's insulating paints and compounds, for which the company is the agent. The products are being specially recommended for electric and steam railroad uses and for dynamo and motor frames, switchboards, cut-outs, manholes and for other uses where a liquid insulator is required.

I. P. FRINK reports the following among the recent orders taken for interior lighting: Normal School, Albany, N. Y.; art gallery of the Lotus Club, New York City; Edward Brandis art galleries, New York City; Administration Building, Bronx Park, and the main entrance and hall of the Harkness Mansion at Fifth Avenue and Seventy-fifth Street, New York. This latter will be lighted by a special system of reflectors which will shine through art glass ceilings.

THE WESTERN WIRE SALES COMPANY, 356 Dearborn Street, Chicago, Ill., has recently been reorganized, Richard Wick, formerly one of the officials of the company, retiring. The officers of the company now are: C. T. Murdock, president; A. N. Allen, secretary, treasurer and manager. The company announces that it will carry on the manufacture of the same line of bare and insulated wires and cables as heretofore, and will cater to the same trade as it did previous to the reorganization.

THE MECHANICAL APPLIANCE COMPANY, Milwaukee, Wis., is building an electrical flour sterilizer and ager, to be used by the Alsop Process Company. This sterilizer consists of an iron box containing revolving rollers, connected to a high-pressure spark coil, to which current is furnished by a 500-volt generator located on the top of the sterilizer. An air blast is provided for blowing out the arc and creating a current of air through the sterilizer, which carries off the gases formed by the arc. These gases in passing through the flour sterilize and age it.

MR. JOHN STURGESS, who is well known in the electrical fraternity through his former connection with the Sturgess Governor Engineering Company, has recently become associated with the Lombard Replogle Engineering Company, Akron, Ohio, with which company he holds the position of general manager. Mr. Sturgess' wide and successful experience with governor design and operation cannot fail to be of great value to this company, which is specializing governor work. An improved type which is just to be put on the market is the result of the experience and collaboration of Mr. Lombard, Mr. Replogle and Mr. Sturgess.

DOSSERT & COMPANY, New York City, report that during the past week they received orders for solderless connectors as follows: 500 special stud transformer connectors from the Westinghouse Electric & Manufacturing Company; 100 cable taps from Henry Newgard & Company, of Chicago; cable taps for a number of large cables from the Falkenau Electrical Construction Company, of Chicago, for the United States Steel plant at Gary, Ind.; a variety of connectors and terminals from the city lighting plant, Holland, Mich.; cable taps from the General Electric Company, and 2-ways from the Brown Hoisting Machinery Company, of Cleveland, Ohio.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., about Feb. 1 will carry in stock a large supply of its regular type "ES" and "PS" panels, ready for immediate shipment. This stock covers straight panels of these two types, 6 to 20 circuits and 2-2 and 3-2 wire. It has just completed a set of steel templates, 704 in number, which are used in drilling each individual panel of the "E," "ES" and "P," "PS" types, illustrated in its catalogue, so that no time is consumed in laying out the boards by hand. The company will also carry a full line of panel slate already enameled (including all slate sides), a complete stock of panel circuits assembled for mounting and has bars already finished, which will insure the purchaser of rapid service. There is no delay incident to the usual method of laying out the boards by hand. The orders go at once to the factory, and the necessary slate, already polished and enameled, is placed under the proper template and drilled in a short time; and the circuits, which are already assembled, are in a few hours mounted on the board. In addition, the Trumbull company carries a complete line of templates which are used for drilling the fastening holes in the iron boxes, one template for each "E," "ES" and "P," "PS" panel listed in its catalog. By this new equipment not only can all orders be rushed through in record time, but with absolute certainty of correctness, and without hold-ups due to mistakes or delays in laying out and marking.

THE PACKARD ELECTRIC COMPANY, of Warren, Ohio, has recently completed a new substantial brick building comprising basement and two stories. This addition was necessitated by the natural growth of the business. A portion of the space is utilized for offices. The transformer department also has a new home in this building. A portion of the insulating materials is handled in the second story. This new building, together with several old ones in the rear, make a very complete little plant. Due attention has been given to possibility of further needs, in the recent purchase of an adjoining tract of land. This company manufactures the "Packard" transformers, which have been on the market since pioneer days. It is using the most expensive grade of silico-vanadium alloy steel. This company has also recently made important improvements in its cloth manufacturing department, and has designed and built new and expensive apparatus, of which N. A. Wolcott, manager of the company, is the designer. The output has been increased more than tenfold. Cambric bias-cut tape is another specialty which is developing very rapidly. The demand for this is occasioned by the fact that it is necessary to use material of this character in place of tape saturated with a rubber compound for all high voltage work. It is cut bias to give it great strength and elasticity. It is very tacky and nice to handle. The manufacture of insulating varnishes is receiving more attention than ever before. The capacity is sufficient to enable it to offer a select line of varnishes to the trade. Ignition cable is one of the company's strong specialty lines. This material has been on the market for the past eight years and has made an enviable reputation for itself.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 5, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

12,906. TELEGRAPHY; P. B. Delany, South Orange, N. J. Reissue. App. filed Nov. 20, 1908. Increases speed, relieves operator from strain and keeps messages secret from a wire tapper by producing short code dot signals and simultaneously transmitting a long signal whose length is determined by the number of dots, then converting at the receiver the long signal into the number of dots locally produced at the transmitting station.

12,907. ILLUMINATING DEVICE; A. W. Beuttell, New York, N. Y. Reissue. App. filed May 13, 1908. A novel mounting for double-ended incandescent lamps having tubular members with spring terminals therewithin to receive the ends of the lamp.

908,439. ELECTROPLATING APPARATUS; C. G. Backus, New York, N. Y. App. filed April 13, 1908. The electroplating cylinder is removable and carried by a pivoted support which allows its removal from the tank. The drum consists of longitudinal strips having openings therein which fasten in suitable heads.

908,444. TELEPHONE-HOOD; H. L. Burrhus, Hornell, N. Y. App. filed Dec. 20, 1907. The hood is lowered over the head of a person using the telephone so as to shut out noise. The receiver and transmitter are inside the hood.

908,463. INSULATOR; F. J. Hight, West Lebanon, Ind. App. filed Feb. 25, 1908. Split insulator for telephone wires containing insulating blocks with means for clamping the split parts of the insulator together.

908,474. METHOD AND DEVICE FOR ELECTRICALLY REGULATING THE SPEED OF PRIME MOVERS, ESPECIALLY TURBINES; F. Von Merkl, Vienna, Austria-Hungary. App. filed Jan. 31, 1908. The regulating mechanism is controlled by a motor which is adapted to be operated by a plurality of single-phase alternating currents, one of which currents varies in phase with relation to the governed apparatus. When the speed of the turbine varies the current is displaced, a rotary field produced in the motor, which in turn operates the regulator.

908,483. BRUSH FOR DYNAMO-ELECTRIC MACHINES; E. T. Mug, Norwood, Ohio. App. filed Nov. 17, 1905. Improvement in pigtail brushes in which the carbon brush has a transverse channel and a channel extending therefrom to the top of the brush with fusible metal filling the channels and a conductor embedded in the metal.

908,484. DYNAMO-ELECTRIC MACHINE; E. T. Mug, Norwood, Ohio. App. filed Nov. 17, 1905. The yoke which carries the brushes of a multipolar machine is divided into two halves and both halves are provided with roller bearings.

908,504. COHERER; F. G. Sargent, Westford, Mass. App. filed May 15, 1908. Improvement on a prior patent, No. 883,241. The coherer comprises a fixed carbon disk, an adjustable metallic plug and a glass cylinder with a spring forcing the cylinder against the disk.

908,538. ELECTRIC-LIGHTING GAS-BURNER; H. L. Baldwin, Washington, D. C. App. filed June 1, 1908. The lever which actuates the gas valve has a crosshead provided with wings which carry an arm that supports the movable electrode. A spring insures movement of the operating means to the limit of its throw after passing the dead point.

908,545. APPARATUS FOR DECOMPOSING ALKALI-METAL AMALGAMS; C. F. Carrier, Jr., Elmira, N. Y. App. filed May 25, 1907. Expedites the action between sodium amalgam and water by means of a body of graphite in contact with the amalgam and electrolyte of the bath.

908,546. CIRCULATING-PUMP FOR ELECTROLYTIC CELLS; C. F. Carrier, Jr., Elmira, N. Y. App. filed Dec. 19, 1907. A mercury conduit extends between the decomposing and oxidizing compartments of an electrolytic cell and a circulating pump circulates the mercury. Used in the manufacture of caustic soda by the aid of a mercury cathode.

908,547. TROLLEY RETRIEVER; N. W. Chamberlain and L. V. Moulton, Grand Rapids, Mich. App. filed April 3, 1908. Automatically takes up the slack of the cord and promptly draws the pole down when the wheel leaves the wire by means of a spring drum actuated by a take-up and retrieving spring.

908,551. TELEPHONE-TRANSMITTER; C. D. Enochs, La Crosse, Wis. App. filed Oct. 2, 1906. A pair of compound electrodes with insulating leaves separating the elements of the electrodes and projecting from the face, the leaves of one electrode interleaving with the leaves of the opposite electrode. Carbon granules are carried between the electrodes.

908,585. FIRE-ALARM; G. P. Leonard, Elkhart, Ind. App. filed March 22, 1907. Gives visual and audible signal, which latter may be thrown out when sending a still alarm, records the alarm and designates the nature of the alarm sent. Combines a visual and audible signal with an electrical device for controlling each apparatus and with means whereby one of the apparatuses may be energized in advance of the other to display the visual signal.

908,603. METHOD OF TREATING ELECTROLYTIC SLIMES FOR THE RECOVERY OF METALS THEREFROM; A. J. McNab, Trail, B. C., Canada. App. filed Nov. 26, 1906. Particularly adapted for recovering silver from the slimes resulting from the electrolytic refining of lead bullion, as for example by the Betts process. The slime is treated with an alkali-sulphide, the solution separated, the metal separated from the solution by electrolysis and the residue roasted.

908,646. INDICATING-FUSE; R. C. Cole, Hartford, Conn. App. filed Jan. 3, 1907. Gives a conspicuous visual indication of the condition of the fuse link within the enclosed fuse by means of an indicator wire having sufficient gas-producing capacity upon its electrical disruption to discharge the screen from the target.

908,647. MOISTURE-PROOF PACKING; R. V. Collins, New York, N. Y. App. filed Feb. 8, 1908. For packing the connection between a railway switch and the operating mechanism located in the ground next to the switch. Details.

908,650. PROTECTIVE SYSTEM FOR ELECTRIC RAILWAYS; A. C. Eastwood, Cleveland, Ohio. App. filed March 6, 1907. Automatically cuts off the power from the train and applies the brakes when the train is about to enter a danger zone. Details.

908,654. CIRCUIT-BREAKER FOR AUTOMATIC SIGNALING APPARATUS; E. A. Everett, Detroit, Mich. App. filed Nov. 9, 1907. Means are provided at the relay for automatically opening the circuit, controlling the signals in case of accident to the relay support or in case of the accidental inversion of the relay. A mercury circuit closer produces the required result.

908,675. FIXTURE FOR ELECTRICITY AND GAS; G. H. Jones, River Forest, Ill. App. filed June 8, 1908. A special combination fixture which when the user gives up gas and sticks to electricity will not be unsightly. The gas burners and gas connections may then be removed.

908,679. THERMOSTATIC SWITCHING APPARATUS; W. V. D. Kelley, Newark, N. J. App. filed Aug. 30, 1905. A switch which is not affected by variations in external temperature and made of a single metal. An electric heater is connected in shunt circuit across the switch contacts in connection with an incandescent lamp whereby when the switch is opened and the heater in series with the lamp the operating current is cut down and when closed the heater is short-circuited and the current flows through the lamp.

908,682. MANUFACTURE OF GLOWING BODIES OF REFRACTORY METALS FOR ELECTRIC LAMPS; A. Lederer, Atzgersdorf, near Vienna, Austria-Hungary. App. filed April 3, 1906. Makes a paste which contains the metal oxide and about three-quarters of one per cent of finely divided metallic aluminum, molds it and reduces by an electric current.

908,686. DYNAMO-ELECTRIC MACHINE OF THE ENCLOSED TYPE; C. E. Lord, Norwood, Ohio. App. filed March 30, 1907. Maintains a circulation of air for cooling and prevents leakage by providing on the shaft near the openings blowers which force air outward through the annual clearance spaces so as to counteract leakage inward.

908,694. ROTARY SNAP ELECTRIC SWITCH; C. G. Perkins, Hartford, Conn. App. filed July 29, 1907. Provides means for indicating the position of the movable contacts and of the condition of the circuits connected with the switch by a shutter of contrasting color. Details.

908,698. SIGNALING SYSTEM; S. A. Reed, New York, N. Y. App. filed Oct. 26, 1905. Relates to an arrangement of ground connections for telephone party lines utilizing condensers to maintain a balance and to afford an impedance sufficient to protect the talking circuit.

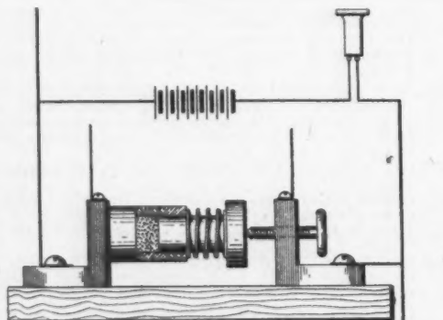
908,707. ELECTRICAL CLUTCH AND THE LIKE; A. P. Steckel, Buffalo, N. Y. App. filed March 23, 1908. Improvement on patent No. 744,423. One member has oppositely arranged separated magnet poles and a second clutch member has a series of ring segments arranged to revolve between the poles.

908,712. ELECTRICAL HEATING APPARATUS; E. L. Van Dolsen, Berwyn, Ill. App. filed Feb. 23, 1906. An electrical soldering iron or the like provided with a support having a pocket wherein the tip of the iron is adapted to rest, the pocket receiving the excess solder whereby the iron is kept tinned.

908,719. TROLLEY-HARP; J. Wickstrom, Warren, Pa. App. filed July 6, 1908. The trolley harp comprises two plates with dove-tailed connection with a pin for the wheel mounted in recesses in one of the plates and held from rotation by the other plate.

908,725. RECEIVER; C. G. Ashley, Chicago, Ill. App. filed Jan. 10, 1906. A wireless receiver, including a source of light, an electrically operated mirror for governing a ray of light, another mirror, the two mirrors producing a resultant ray and a signal actuated by the ray.

908,483 — Brush for Dynamo-Electric Machines.



908,504—Coherer.

908,726. PORTABLE ELECTRICAL TOOL; F. J. Backscheider, Cincinnati, Ohio. App. filed Sept. 27, 1907. A drill in which the operating motor is controlled by a switch which is automatically thrown off when the tool becomes stalled.

908,742. SPACE TELEGRAPHY; S. Cabot, Brookline, Mass. App. filed March 18, 1907. Prevents arcing at the spark gap and increases the power factor of the power circuit by means of an intermediate circuit with a condenser connected across it, so proportioned as to increase the power factor.

908,748. ELECTRIC BLOCK-SIGNAL; J. G. O. Combs and I. D. Combs, Walnut Grove, Mo. App. filed March 5, 1908. Prevents rear-end collisions by notifying the engineer of the train. The mechanism for operating the signal is duplicated so as to set the signal to indicate danger on entering the block and on leaving the station. Details.

908,814. CONDENSER; John Stone Stone, Cambridge, Mass. App. filed Dec. 28, 1905. A condenser for wireless telegraphy in which two dielectrics are used, one glass, the other air, the former having a high dielectric strength and the other perfect electrical elasticity.

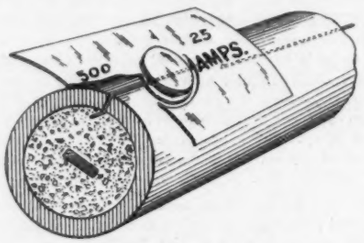
908,815. SPACE TELEGRAPHY; John Stone Stone, Boston, Mass. App. filed March 25, 1908. Increases the power factor of the primary power circuit by a special improvement over the Cabot patent, 884,070. Details.

908,846. TELEPHONE RECEIVER; Jesse Temple Curtis, Bement, Ill. App. filed July 9, 1907. Places the diaphragm in a condition of permanent stress in a plane at right angles to the vibration of the diaphragm.

908,848. ELECTRIC SIGNAL-BELL; H. W. Eden, Detroit, Mich. App. filed Jan. 4, 1908. An improved contact point supporting post and improved insulating means for securing a binding post to the frame. Details.

908,868. MEANS FOR CLOSING AN OPEN TELEGRAPH-CIRCUIT AT A DISTANT KEY; C. B. Jewell, La Junta, Colo. App. filed March 14, 1908. Avoids the time lost in running down "open keys" on train dispatching lines. An extra switch and circuit and a high voltage extra battery are provided at the terminal office which when switched on to the line wire forces its current through the resistance around any open key, works the relay of the key and warns the forgetful operator that he has left his key open.

908,895. ELECTRIC RAILWAY-SIGNAL; C. H. Smith, Lebanon, Pa. App. filed Dec. 7, 1907. A trolley contact actuated by the passage of



908,646—Indicating Fuse.

a car in one direction only, consisting of means located adjacent to the trolley wire, engaged by the trolley wheel to close a signal circuit so as to notify one of the approach of a train.

908,899. ELECTRIC BELL; E. P. Steen, Cripple Creek, Col. App. filed May 19, 1905. An improved single-stroke electric bell worked from an alternating current circuit comprising a gong, a coil, an iron core for the coil which acts as a hammer for the gong, the parts being so constructed that the magnetic circuit of the coil has a large air gap when the core is withdrawn and a small air gap when the core is within the coil.

908,918. BURGLAR-ALARM; John Wells, Forsyth, Mont. App. filed June 28, 1907. Door and window burglar-alarm controlled by a trigger actuated by the movement of the door or window. Details.

908,926. THREE-WIRE TELEPHONE SYSTEM; C. S. Winston, Chicago, Ill. App. filed March 12, 1906. Reduces the impedance in the talking circuit of a three-wire system. Provides a cut-off relay and a supervisory relay in the third wire and a second supervisory relay connected between a source of current and the sleeve strand of the cord circuit with a supervisory signal having a circuit jointly controlled by the supervisory relays.

908,930. METHOD OF DECARBONIZING FILAMENTS FOR INCANDESCENT LAMPS; Hermann Zerning, Halensee, near Berlin, Germany. App. filed Oct. 30, 1906. Completely decarbonizes a filament without injuring the metal by means of nitrogen gas produced by heating phospham (PN_2H).

908,937. REMOVAL OF METALLIC PLATING, COATING OR FOULING FROM METALLIC OR OTHER SURFACES; T. R. Bayliss, et al., Northfield, near Birmingham, England. App. filed Feb. 18, 1908. Connects the article so as to make it an anode and confines an ammoniacal liquid against the surface of the articles, then introduces and rapidly rotates a cathode within the article.

908,979. AUTOMATIC SWITCH-LOCK; C. E. Duffie, Omaha, Neb. App. filed July 25, 1907. For automatically locking a railway switch upon the approach of a train by means of an electrical circuit with train operated means for opening and closing the circuit and train operated means for closing a shunt in the circuit around the first mentioned train operated means.

908,981. TROLLEY POLE ATTACHMENT; H. W. Eichbaum, Los Angeles, Cal. App. filed March 28, 1908. A simple means for operating signals, etc., from electric cars while in motion. A contact member is arranged adjacent to the trolley wire and is electrically connected with the signal and a mechanically operated contact member is carried by the trolley pole and electrically connected through the car with the signal. Fluid pressure means place the contacts in the path of one another when the circuit is to be closed.

909,017. APPARATUS FOR PREPARING OXONE; D. E. Parker, Niagara Falls, N. Y. App. filed May 18, 1906. Makes oxone (formed by fusing peroxide of sodium) by an apparatus comprising a melting pot, electrodes dipping into the pot with means for connecting the electrodes to a source of energy. The melting pot is pivoted on standards beneath a hopper.

909,030. ELECTRICAL CONNECTOR; G. A. Schreier, Auburn, Ill. App. filed Feb. 16, 1907. For use in connection with flexible conductors for mining motors when the train enters a room in the mine into which the trolley wire does not extend. The end of the flexible conductor may be quickly connected with a terminal socket and is automatically disconnected when the motor returns.

909,043. ELECTRICAL SPARK APPARATUS; E. C. Wilcox, Meriden, Conn. App. filed Nov. 25, 1905. The apparatus may be assembled in units, each unit having the usual primary and secondary coils, together with a vibrator.

909,057. ELECTRIC MOTOR; James Burke, Erie, Pa. App. filed Jan. 20, 1905. A plurality of motor armatures are arranged to drive a common shaft, being disposed around the shaft and geared thereto.

909,092. CALL-BELL; Saul Katz, New York, N. Y. App. filed Dec. 19, 1907. The bell may be connected up through three different circuits with a single battery to give three different signals dependent upon which of the three circuits is closed by its respective push button.

909,120. ELECTRIC-CURRENT GOVERNOR FOR DYNAMO-ELECTRIC MACHINES; Leopold Rosenbaum and Frank Voglhut, New York, N. Y. App. filed Jan. 30, 1908. Operates by centrifugal force to cut in resistance under excessive speed and to cut out resistance when the speed decreases. Brushes are carried by the centrifugal device and a rheostat with terminals surrounds the centrifugal and connects with the brushes to increase or decrease the resistance.